AD-A152 549 PROCEEDINGS OF THE ANNUAL MEETING (26TH) TECHNICAL DOCUMENTATION DIVISION..(U) AMERICAN DEFENSE PREPAREDNESS ASSOCIATION ARLINGTON VA 10 MAY 84 1/4

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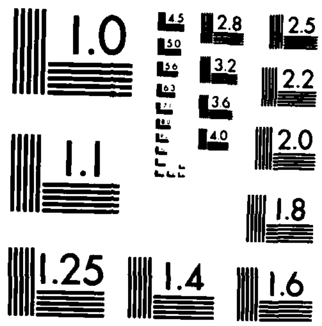

MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

PROCEEDINGS

TWENTY-SIXTH ANNUAL MEETING

TECHNICAL DOCUMENTATION DIVISION

7-10 May 1984

EL Tropicano Hotel
San Antonio, Texas

AMERICAN DEFENSE PREPAREDNESS ASSOCIATION
NATIONAL HEADQUARTERS: Rosslyn Center, Arlington, Virginia 22209

AMERICAN DEFENSE PREPAREDNESS ASSOCIATION

DEDICATED TO PEACE WITH SECURITY THROUGH DEFENSE PREPAREDNESS

Founded 1919

Dear Fellow ADPA Member:

Your response to this questionnaire is requested to help us identify problems with Technical Documentation in the defense industry. The Technical Documentation Division is proud of the close and effective relationship between its industry and government members. It is through this relationship that we can identify and resolve problems for the simplification and improvement of Technical Documentation. Your participation is essential.

Please take a few minutes, complete the following questionnaire, and mail it to:

T. L. Golmis
Hughes Aircraft Company
Bldg. 604, M/S B-114
P. O. Box 3310
Fullerton, CA 92634

---

1. What feature or talk given at the 1984 meeting was the most informative? ______________________

   . . . Helpful to you? ______________________

2. What problems are you having that you would like to see resolved?

   ____

   ____

3. What subjects would you like to hear discussed at the 1985 meeting to be held in Phoenix, Arizona (dates to be determined).

   ____

   ____

Your answers will be reviewed by the TDD Executive Board. Where necessary, ad hoc committees of industry and government members will be created to work your problems.

Sincerely,

T. L. Golmis
Chairman,
Technical Documentation Division

TLG/cvc

P.S.: Additional comments and suggestions are invited.

AMERICAN DEFENSE PREPAREDNESS ASSOCIATION

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THE MISSION

OF

THE AMERICAN DEFENSE PREPAREDNESS ASSOCIATION

The American Defense Preparedness Association exists solely for the advancement of adequate national defense of the United States in the fields of weapons technology, production, and logistics. We strive to improve the effectiveness and efficiency of the Government-Science-Industry relationship in the development and production of weapons and weapons systems. Our field of interest covers all ordnance, armament, weapons, weapons systems, and related equipment for the Armed Forces of the United States. Our interest also includes techniques, processes, and materials that have wide application in the development, production, and logistics of weapons.

Through its publications and meetings--national, local, and technical--the Association endeavors to educate its members and the public on problems affecting weapons preparedness. Our technical divisions provide advice to Government agencies on weapons technology.

The Association, founded in 1919, is a non-profit and non-political organization. It is an association of individuals as distinguished from an organization of commercial companies. The ten persons nominated by company members participate as individuals.

It is not within the scope of any American Defense Preparedness Association meeting or activity to discuss or be at all concerned with matters of trade, procurement, price, market or control or with placement of specific contracts or allocation of materials.

The Association cooperates to every practical extent with other recognized technical and industrial associations in assisting the Armed Services of the United States. Its mission is to keep America's armament strong in peace and in war. Its functions are as important and as worthy of support in times of international quiet, as well as in emergency. It is a peace society in purpose, in operations, and in fact.

AMERICAN DEFENSE PREPAREDNESS ASSOCIATION

TECHNICAL DOCUMENTATION DIVISION

STATEMENT OF AIMS AND PURPOSES

The Technical Documentation Division, ~~is~~ part of the Defense Management Group of the American Defense Preparedness Association. The division was formed to provide the government and industry access to a group of experienced and responsible administrators and specialists from various sectors of industry, qualified to assist in the formulation of government and industry requirements for technical documentation. The members participate as individuals rather than representatives of their companies.

The division is concerned with all aspects of technical documentation: conception, analysis, preparation, management, control, and dissemination. The division's field of interest includes engineering drawings and standards, policies and procedures, technical publications, specifications, configuration controls, computer-aided documentation techniques, and methods of data communication. Duplication of effort by other technical and industry associations is avoided.

Sections/Committees are established to study problems and submit resulting reports and recommendations. Section/Committee participation by an individual is voluntary and evidences his desire to comprehend government and industry needs, to reduce the complexity and cost of technical documentation, and to enhance standardization with a sincere interest to serve with other members to achieve these goals.

Division/Section members interface frequently with their counterparts in government and industry. This association serves as a clearinghouse for professional information interchange and provides a stimulation which contributes toward the success of the participant's work and enhances the individual's value to his employer.

In addition to section/committee reports on subjects completed or in process, the Technical Documentation Division convenes annually and conducts a program of timely subjects to keep the members and the public informed, alert, and interested in the problems and solutions associated with technical documentation vital to our national defense, industrial accomplishments, and other related programs.

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Preparation and Management of Specifications Section	S. Alvine, Jr.
Technical Publications Section	R.E. Knob

Award Presentation May 8th, 1984

THE

R.H. STEARNS

AWARD

Presented to

Richard E. Knob

In every field of human activity there are those who lead and those who are led. Occasionally, among the leaders there are individuals who achieve superior stature. In the field of Engineering Documentation, Robert H. Stearns was one who, through dedication to principle and aggressive pursuance of duty, earned outstanding recognition in both industry and military circles.

Born in 1906 in New York City, Mr. Stearns' career included training both as a machinist and in engineering at White Motor Co., and as a drawing checker, chief checker, chief draftsman and engineering consultant during twenty-five years of service with the Douglas Aircraft Company.

He was also active personally and as the Douglas representative on various industry association activities, special advisory committees to the Department of Defense and with the Engineering Data Management Section of the American Ordnance Association. He was taken from us by a most unfortunate aircraft accident en route home from a meeting of the Steering Committee of the Engineering Data Management Section in February 1962.

In recognition of his outstanding achievements, the *Robert H. Stearns Award* was established for the purpose of honoring Mr. Stearns and as a vehicle to recognize and honor those who might exhibit comparable qualities and achievement in the future. Specifically, candidates for the Award are judged on the basis of demonstration of outstanding qualities in the following attributes:

- Devotion to the field of documentation and meaningful achievement therein
- Vigorous and articulate in establishing and logically supporting a position
- Energetic with singleness of purpose
- Patriotic, honorable, pleasant, humble, sincere.

PAST RECIPIENTS OF THE AWARD

The Family of R. H. Stearns	**1963**
W.W. Thomas	**1964**
P.C. Weissbrod	**1966**
J.H. Mars	**1968**
D.S. Scott	**1969**
P.G. Belitsos	**1969**
C.A. Nazian	**1970**
J.L. Flippo	**1970**
R.F. Franciose	**1971**
G.D. Christensen	**1972**
C.A. Fricke	**1973**
J.R. Meitz	**1974**
D.R. Mitchell	**1977**
H.R. Lowers	**1978**
M.E. Taylor	**1979**
T.L. G[illegible]lmis	**1980**
R.[illegible] Rau	**1981**
V.F. Mayolo	**1982**

Mr. Richard E. Knob has been actively engaged in the field of Technical Documentation for over thirty-six years. He is a Graduate of Union College and has completed Graduate courses at Polytechnic Institute of New York and at Harvard University. He was listed in Who's Who in the East, 1979/1980.

Mr. Knob joined Sperry Gyroscope Division of Sperry-Rand Corporation, Great Neck, New York in 1947 as a Publications Engineer and is now Manager of Publications.

During World War II he served with the U.S. Navy for four years as a Lt. J.G.

Mr. Knob joined the Engineering Data Mangement Section of the American Defense Preparedness Association in 1960 and has been Chairman of the Technical Publications Section since 1968. During this period he provided such leadership functions as: Co-chairman "Equipment Manuals Symposium" in Detroit, Michigan in 1965, the first in a series of army briefings on latest automation approaches for preparation of technical manuals; program Chairman Technical Publications section meeting on "Computer Aided Education" held at the U.S. Naval Academy in 1969; Chairman for six (1978-1983) Technical Publications workshops held during annual meetings of the Technical Documenation Division.

He is a major contributor to the development of ADPA responses to numerous drafts of Government Technical Manual Specifications & Standards.

Considering his ADPA activities for over 20 years he can be cited for his dedication to improving Technical Communications (Technical Manuals, Proposals, Reports, Provisioning Documentation) within and between industry and Department of Defense components. His contributions have provided information and different view points to improve understanding. His key concern in recent years has been the impact of changing conditions brought about by automation and other technological advances. He has observed, first hand, the operation areas and has encouraged feedback from the Technical Communication Users.

He and his wife Helen, live in Wantagh, New York. They have six children and twelve grandchildren.

Mr. Knob enjoys boating, tennis and swimming.

A person who possesses the unique qualities and high standards to merit this award – devotion to the field of documentation, articulate, energetic, patriotic, pleasant, sincere, honorable – is Richard Knob.

SESSION 1

Chairman: MR. SAMUEL ALVINE
The Singer Company
Kearfott Division

Secretary: MR. CHARLES D. FISHER
RCA, Government Communications
Systems

AMERICAN DEFENSE PREPAREDNESS ASSOCIATION

TECHNICAL DOCUMENTATION DIVISION

1984 ANNUAL REPORT

BY

THEODORE L. GOLMIS

MANAGER, CONFIGURATION AND DATA MANAGEMENT OPERATIONS

HUGHES AIRCRAFT COMPANY

AND

CHAIRMAN, TECHNICAL DOCUMENTATION DIVISION

Good Morning, Ladies and Gentlemen. I would like to welcome you to the 26th Annual Meeting of the Technical Documentation Division and take this opportunity to thank the Executive Board and in particular our Program Manager, Bob Carrier of the Raytheon Company and Captain Nelson Jackson of ADPA Headquarters for their efforts.

The Technical Documentation Division is part of the Technology and Management Advisory Services of ADPA. The Divison was formed to provide the Government and Industry access to a group of experienced and responsible specialists from various sections of industry qualified to assist in the formulation of government and industry requirements for technical documentation. Members participate as individuals rather than representatives of their companies.

Our Sections/Committees are established to study problems and submit resulting reports and recommendations. Their objective is to comprehend Government/Industry needs, to reduce complexity and cost of technical documentation, and to enhance standardization with other members to achieve these goals.

Our Sections/Committees interface frequently with their counterparts in Government. This association serves as professional information interchange and contributes to solutions associated with technical documentation vital to our national defense and industrial accomplishments.

I would like to take this opportunity to introduce the Executive Board.

Since our meeting at Fort Monroe, Virginia last year, the Executive Board has met in Kent, Washington at the Boeing Aerospace Company and in Alexandria, Virginia at the Defense Logistics Agency, Cameron Station.

In line with our efforts to maximize technology transfer, we attempt to meet with individuals who can contribute to our objectives. At Boeing, the President Elect of the ADPA Northwest Chapter provided us a briefing and overview of Boeing's activity, as related to ballistic missile weaponry. One of the highlights of our meeting was the tour of the Assembly Facilities where the 747 and new 767s are produced.

At DLA, Cameron Station, we were extremely fortunate to have Mr. John Mittino, Assistant Deputy Under Secretary of Defense for Production Support address the Executive Board and Guests. He stated that ADPA is recognized as a staunch supporter of our Nation's defense efforts. Mr. Mittino also stated that DOD/Industry changes are inescapable in the area of:

- o New methods in the acquisition of data.
- o New methods in data management.
- o Reduction of data (13,000 data lists when services-owned; now, more things will be happening with less data).
- o Determining data requirements before new contracts is going to be difficult in evolving "Star Wars" environment.
- o Data "accountability" is increasing.
- o Stress the use of the same data and formats used by industry.

Disadvantages of changing data requirements:

- o Planning and education (especially in DOD) is critical in the areas of:

    1. Increased needs for data base system and security.
    2. Impact of prime-to-subcontractor data problems where the subcontractor will not normally have any data base system(s).
    3. Pricing of data will be more difficult - how do you price this evolving "electronic" data?

On the non-technical side -

- o Large impact of automated data base trend on the way we do business today in the areas of:

  1. Handling/transfer of engineering drawings.
  2. Engineering data base repositories.
  3. Technical manuals.

- o What would characteristics of 1990 manuals be?

- o Probably always will be a requirement for paper; however, data can be tailored to specific needs by the automated data base systems (e.g., automatic listing of tools and parts by computer).

At this same meeting, the Defense Material Specifications and Standards Office (DMSSO) provided a report which included:

Technical Manuals - Mr. John T. Winters addressed the present inability to update technical manuals in a timely manner and the potential of the Automated Publication System (APS) in resolving that problem.

Mr. Carl Berry discussed Data Item Descriptions and Paper Reduction.

Mr. James Dalgety provided an insight into the Efforts to Automate Technical Data Repositories.

Mr. James D. Richardson provided the following conclusion to the DMSSO report:

- o Operational system by this time next year (1985).

- o Only 4% of data items are affected by "proprietary rights".

- o 8% of technical data that is acquired is never received.

- o Level 3 drawing packages often do not include required reference data.

- o Manufacturing data would increase technical data total by 60%.

- o Manufacturing data is normally tailored to one manufacturer and useless to DOD.

- The Brooks Committee is studying acquisition of all data. Expect this report back by March.

Mr. Philip W. Clark made a presentation regarding DLA technical data management and acquisition:

- Emphasis on tech data systems and spares support.
- Automation of Data Repositories.
- Need resolution of drawing acquisition problems.
- Get industry to help DLA in data acquisition.
- DLA looking at improvements and plan of action - would like any industry inputs.

I feel these two meetings were outstanding from the standpoint of information and interfacing with the right people.

Another significant event of the year was the Classified TMAS Meeting held at the National War College. Six Deputy Under Secretaries of Defense made presentations, including Richard D. Delauer and Mary Ann Gillece.

Our exchange with many of the Government and Industry activities is very rewarding and is based upon mutual concern for our defense posture, improving productivity and reducing overall costs. I am, however, concerned over the near future. My concern is for "bad press" and our reaction to half truths or exceptions rather than to the "norm".

One area of concern is that of data acquisition. It would appear that certain legislation in response to "spares breakout", acquisition of competitive reprocurement packages, and proprietary rights is creating a great deal of confusion and may ultimately result in significantly higher costs for data.

To evidence my concern, let me read from some of the new legislation:

98th Congress, 1st Session, H.R.4092, Technical Data, Sec. 6
Section 2386 of title 10, United States Code:

> "(b)(1) Except as provided in paragraph (3), funds appropriated to a military department that are available for the development or production (whether by a domestic or foreign contractor) of a major weapon system shall also be used for the acquisition of all manufacturing data relating to such system.

"(2) Each contract made by a military department after the date of the enactment of the Small Business Competitive Procurement Act of 1983 for the development or production of a major weapon system shall contain provisions necessary to carry out the purposes of paragraph (1), including conditions under which the contractor waives proprietary rights with respect to any manufacturing data necessary for the performance of a contract for the production of that weapon system by another manufacturer".

On a recent proposal in a DOD FAR Supplement we find 52.246-7001 Warranty of Data. As prescribed at 46,770, insert the following clause:

WARRANTY OF DATA (NOV 1974) . . . the Contractor warrants that all technical data delivered under this contract will at the time of delivery conform with the specifications and all other requirements of this contract. The warranty period shall extend for three (3) years after completion of the delivery of the line item of data (as identified in DD Form 1423) of which the data forms a part; or any longer period specified in the contract."

"(3) In additon to the remedies specified under (d)(1) and (2) above, Contractor shall be liable to the Government for all damages sustained by the Government as a result of breach of the warranty specified in this clause".

"(i) with respect to the requirement under Category E or I of MIL-D-1000, provided that the data furnished by the Contractor was current, accurate at time of submission and did not involve a significant omission of data necessary to comply with such requirements;"

It should be noted that MIL-D-1000 and application of Categories has been obsolete for approximately 10 years.

In a recent proposed modification of Paragraph (h) of DAR 7-104.9 (a) it stated

"(3) The contractor shall notify the contracting officer whenever a component, module, assembly, or part can no longer be acquired, is no longer being manufactured, or is declared obsolete by its manufacturer. The notification shall be made no later than thirty days after the contractor is notified by a subcontractor, or becomes aware through another source, of the discontinuance or obsolescense of the item."

"(5) For the purposes of this clause, the Contracting Officer shall have the right to direct the contractor to deliver all technical data and computer software, described in subparagraph (1), at any time following the 60th month after the delivery of the first item or at any time following two years after the acceptance of all items (excluding data and computer software) to be delivered under this contract or termination of this contract, whichever is earlier."

98th Congress 1st Session H.R.2133 states in (4)(A)

"Such rules and regulations shall be promulgated as a part of the Federal Acquisition Regulations and shall give due consideration to the following -

"(ii) the governmental interest to increase competition and lower costs by developing and locating alternative sources of supply and manufacture;

(iii) directing appropriate purchasing agencies to establish reverse engineering programs which provide domestic small business concerns an opportunity to purchase or borrow spare or replacement parts from the Government for the purpose of design replication or modification to be used by such concerns in the submission of subsequent offers to sell the same or like parts to the Government:"

"(v) a requirement that the procuring agency, with respect to each major system acquisition, insert a clause in the initial production contract pertaining to technical or other data developed in whole or in part with Federal funds. Such clause shall contain provisions specifying, as appropriate, the Government's right to own, license, use or otherwise access such data and the extent, if any, or proprietary interest maintained by the contractor; and

"(vi) the imposition of appropriate remedial measures against business concerns which improperly designate technical or other data as proprietary."

And finally we have the Nichols' Bill, an Amendment In The Nature of A Substitute to H.R.5064, adopted by the Committee on Armed Services, April 3, 1984. This Bill requires extensive study but my first reaction to the draft is one of great concern. We will have an opportunity to discuss the subject later at the Configuration Management Workshop.

If such as I have read doesn't drive data costs out of sight, compound the problem with current attempts at automation, CAD/CAM, and data base management, try to combine unrealistic requirements with new and undeveloped methods of information transferred and then try to predict the results. The acquisition of magnetic tapes, discs, electronic transfer of digitized data without intelligent control can smother the government with costly useless information.

It is apparent that various disciplines in this country interpret data requirements in many forms. I feel that it is extremely necessary for government/industry to pull together these disciplines which normally do not talk to each other and make sure that their requirements for data are not redundant, not inappropriate or overly costly to government and the taxpayers. This country has been built on a competitive system and that competitive system must be protected.

DOD Instruction 5010.12 does not suggest that Contractors be managed or monitored through deliverable data. Data should stand alone to support the mission.

At last year's meeting, in my annual report, I stated that American productivity was down due to the lack of intelligent application of resources. I stated that the majority of us spend most of our time investigating problems and negotiating a course of action rather than resolving the problem. Most of these problems stem from interpretations of contract specification and standards requirements. The problem is complicated by the remoteness of our customers and the inability to obtain decisions in a timely manner, coupled with the conflict of Government requirements versus the way a company does or wants to do business. As a result, there are roadblocks, frustration, misinterpretations, misapplications and, in general, an overall reduction in productivity.

It was at this point that I asked what we could do about it? In particular, what could ADPA and the Technical Documentation Division do about it?

ADPA and, in particular, the Technical Documentation Division, as a strong government/industry team can and must put its shoulder to the wheel and resolve these problems whether they be real or fictional. We must educate all factors of the military/industry complex. The areas of concern include the acquisition process, appropriate tailoring to reduce costs, adequate coverage for life cycle support, spares breakout,

and adequate design disclosure protection of proprietary rights.

I hope from this 26th Annual Meeting we can come up with recommendations which will improve the current working environment.

Thank you.

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ON

TECHNICAL DOCUMENTATION

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Technical Data Division
Defense Material Specifications
and Standards Office

Panel:

Capt. David L. Boslaugh, USN
Director Embedded Computer Systems
Naval Material Command

Mr. Robert R. Hegland
Senior Computer Specialist
US Army Computer Systems Command

Dr. Larry M. Lindley, Program Mgr.
Embedded Computers and Tactical Software
Navy Avionics Center

Mr. D. Berton Newlin, DMSSO
General Engineer and Sr. Staff Specialist

See Sections B, C, D, and E for Government panel reports.

STANDARDIZATION AND OVERVIEW OF DOD SOFTWARE DOCUMENTATION ACTIVITIES

BY
D. BURTON NEWLIN, JR

DEFENSE MATERIEL SPECIFICATIONS AND STANDARDS OFFICE
OFFICE OF THE UNDER SECRETARY OF DEFENSE
(RESEARCH AND ENGINEERING)

ABSTRACT: The Department of Defense has become increasingly dependent on computer technology to accomplish its mission since our defense strategy is based on high technology. Computer costs are consuming a larger percentage of the DoD's budget and this percentage is increasing. The major cost involves the acquisition and maintenance of the computer software, which is labor intensive, while the computer hardware costs are continuing to decline. Our future success on the battlefield will depend on the maturity of our computer technology and its applications. Four major programs form the basis for our computer technology program. These are our VHSIC, Ada, STARS and Strategic Computing Programs. The VHSIC Program is addressing the hardware issues. The Ada and STARS programs are addressing the software issues. Recently a policy decision was made within the Department of Defense to mandate the use of Ada for mission-critical applications. The Strategic Computing Program is addressing the areas of application and use of artificial intelligence and expert systems technology.

Public Law 96-511 is an important law that was passed to encourage the transition from our current paper information society to an electronic information society. One of its purposes is to ensure that automatic data processing and telecommunications technologies are acquired and used by the Federal Government.

The development and documentation of software has become a critical component in the weapon system development, deployment, maintenance and logistics processes. Two of the major documentation standards activities within DoD involve the Automated Data Systems Documentation Standard, DoD-STD-7935, used by the ADP community and a new standard being developed by the Joint Logistics Commanders, MIL-STD-SDS, Defense System Software Development Standard.

KEY WORDS: Ada, Computer, P.L. 96-511, Software Documentation, Standardization, STARS, Strategic Computing, VHSIC.

Computer Technology is a Critical Defense Resource

Dr. Martin, the Deputy Under Secretary for Research & Advanced Technology, made the following statement before the Defense Appropriations Subcommittee.

"The United States' potential adversaries are numerically superior, technologically sophisticated, well equipped, and prepared. Years ago the United States made the decision not to match its potential adversaries, mainly the Soviet Union and the Warsaw Pact, on a person for person, tank for tank basis. Instead we decided to base our defense strategy on superior technology. A main ingredient in our technology strategy is the use of "smart" weapons; i.e., weapons and weapons systems which have computers and software as integral components. In fact, computers and software have become essential to the military mission. Almost every defense system fielded today contains a computer and has sensors, electronic warfare systems, intelligence analysis, weapon system control, communications, command and control, navigation, surveillance, target acquisition, and combat support services. We believe that the future success on the battlefield will depend on the maturity of our computer technology and its applications" [1].

The Department of Defense has become increasingly dependent on computer technology to accomplish its mission. Computer costs are consuming a larger percentage of the DoD's budget and its percentage is increasing. The major cost involves the acquisition, maintenance and improvement of the computer software or computer programs, which are labor intensive, while the computer hardware costs are continuing to decline [2]. Four major defense programs form the basis for our computer technology program. These are our VHSIC, Ada, STARS and Strategic Computing Programs.

VHSIC Program

One of the highest priority technology programs in the U.S. Department of Defense is the Very High Speed Integrated Circuits (VHSIC). The program is aimed at developing silicon chips that will be fast and reliable enough to ensure continuing U.S. superiority in defense electronics. The VHSIC Program will emphasize innovations in design architecture, software and testing that are key elements to achieving the programs goal of building military systems which execute tens of millions of instructions per second. Reducing size and increasing the number of functional components on a chip will lead to significant increases in speed simply by reducing the time needed to move a bit of information from one part of the system to another. The program is being executed by six of the nation's contractors, Honeywell, Inc., Hughes Aircraft Co., IBM Corp., Texas Instruments Inc., TRW Inc., and Westinghouse Corp.

Ada* Programming Language

A major emphasis on the standardization of high order languages for weapon system computer application is being placed on the Ada programming language specified in ANSI/MIL-STD-1815A-1983 [3]. Ada was developed to provide the foundation for standardization of software used in real time computer applications and to reduce both the initial acquisition and life cycle maintenance costs of major systems. Ada, which has been adopted as an

*Ada is a trademark of the U.S. Department of Defense.

American National Standards Institute (ANSI) standard. As an ANSI standard, this will hopefully expand the use of Ada to other communities outside the Department of Defense and improve the overall software development and software transportability difficulties we face today.

On June 10, 1983, Dr. Richard DeLauer, Under Secretary of Defense released a memorandum regarding Interim DoD policy on Computer Programming Languages.[4] This memorandum states that "the Ada programming language shall become the single, common computer programming language for Defense mission-critical applications. Effective 1 January 1984 for programs entering Advanced Development and 1 July 1984 for programs entering Full-Scale Engineering Development, Ada shall be the programming language. "Mission-critical" applications are those exempted from the Brooks Act by 10 U.S.C. 2315, as stated in the Warner Amendment to the FY 1982 Defense Authorization Act." Mission critical systems include the following: (a) Intelligence systems, (b) Cryptologic Systems related to National Security, (c) Command and control of military forces, (d) Integral part of a weapons system, or (e) Critical to the Direct Fulfillment of Military or Intelligence Missions.

STARS Program

The Department of Defense has introduced a software initiative called the Software Technology for Adaptable, Reliable Systems (STARS) Program.[5] This program is directed at controlling the cost growth and improving the quality and productivity of DoD computer software embedded within our weapon systems, which has been predicted to reach $32 billion within DoD by 1990. The goal of STARS is to improve the software environment while achieving greater systems reliability and adaptability. The program is aimed at achieving major improvements in the development and life cycle support process, to make this process faster, less expensive, and more predictable. Software documentation is an issue the STARS Program will address.

STARS will create an "Automated Software Factory", a coherent and integrated system of computerized software tools and reusable software parts and building blocks. Through the Automated Software Factory concept, orders-of-magnitude increases in software productivity will be achieved, as will comparable reductions in the number of software defects latent in fielded weapon systems. The Automated Software Factory concept will address all of the dimensions of software activities including software engineering, software documentation, project management, and software acquisition. It also will build reusable libraries of software modules applicable across the wide range of functional areas addressed by mission-critical defense systems, e.g., navigation, intelligence, and communications. Versions of the Automated Software factory will be used throughout the Services, Defense Agencies, and industry.[6]

Strategic Computing Program

The Defense Advanced Research Project Agency (DARPA) has initiated an important new program in Strategic Computing to meet the challenge of certain critical problems in defense. By seizing an opportunity to leverage recent advances in artificial intelligence, computer science, and microelectronics, the Agency plans to create a new generation of "machine intelligence technology." This new technology will have unprecedented capabilities and promises to greatly

increase our national security and our economic strength as it emerges during the coming decade. We are now challenged to produce adaptive, intelligent systems having capabilities far greater than current computers, for use in diverse applications including autonomous systems, personalized associates, and battle management systems. Advances in "expert system" technology now enable the mechanization of the practical knowledge and the reasoning methods of human experts in many fields. Advances in machine vision, speech, and machine understanding of natural language provide new ways for humans to interact with computers. New ways to structure the architectures of computers enable computations to be processed in parallel, leading to large improvements in machine performance. Finally, new methods of microsystem design and implementation enable the rapid transfer of new architectural concepts into state-of-the-art microelectronics. The overall goal of the Strategic Computing Program is to provide the United States with a broad line of machine intelligence technology and to demonstrate applications of the technology to critical problems in defense.[7]

Public Law 96-511, The Paperwork Reduction Act of 1980

An important law that has a major impact on software documentation is the Paperwork Reduction Act of 1980, Public Law No. 96-511,[8], which establishes policies and procedures for controlling paperwork burden imposed by federal agencies on the public. This law was passed to encourage the transition from our current paper society to an electronic information society by ensuring that automatic data processing and telecommunications technologies are acquired and used throughout the Federal Government. The purpose of the law is:

> "(1) to minimize the Federal paperwork burden for individuals, small businesses, State and local governments, and other persons;
> (2) to minimize the cost to the Federal Government of collecting, maintaining, using and disseminating information;
> (3) to maximize the usefulness of information collected by the Federal Government;
> (4) to ensure that automatic data processing and telecommunications technologies are acquired and used by the Federal Government..."

In April 1983, after four years of debate on the application of the law to DoD's Contract Data requirements, which had previously been exempted, OMB and OSD Counsel rules that all DoD contract data requirements must be approved and controlled by OMB. Three clearances were obtained by DoD from OMB. The first was a blanket clearance of all solicitation documents, such as RFP's, RFQ's. etc., under one approval and expiration date. The second was a blanket clearance of all FAR/DoD Supplement requirements and DD forms imposed by FAR under one approval and expiration date. The third was a blanket clearance of all current data requirements and collection requests listed in the Acquisition Management Systems and Data Requirements Control List (AMSDL). Based on the clearance for the AMSDL it is the only authorized list of "data item descriptions" approved for contractual usage.

The Role of Standards in Our Accelerating High Technology Society

Standards are an essential element to our high technology society, yet most people understand very little about standards, what they do, who develops them, or who uses them; they accept standards and take them for granted. For instance, one of our most widely used standards in the United States is the English language. Because of our world leadership position in the industrial era and in science and technology, English has been universally accepted as the language for communicating technical ideas in technical journals and publications. But, although English is the predominant language in the U.S., only 15% of the world's population speaks or understands English.

Within the Federal Government many of the computer standards which are used throughout the ADP community, such as the Federal Information Processing Standards (FIPS), are mandatory. FIPS are developed by the National Bureau of Standards. But, within DoD, our military standards are either established by concensus or decision. Very few of DoD's standards are mandatory because of law or policy. Since computer languages had been allowed to proliferate, the DoD was found to be in a position where it is now supporting over 450 separate and Service unique variations of computer programming languages. This has become a costly and unmanageable situation. Mandating Ada for mission critical applications is intended to increase productivity, encourage competition and ensure that computer programs can be maintained and supported in the future. This would allow more of DoD's limited computer resources to be freed to concentrate on specific applications.

The standards development process often takes 5-10 years to obtain consensus, before it becomes widely used and accepted. In today's high technology era the time needed to develop related or associated standards must keep pace with the associated technology. Today, technologies such as computers, telecommunications, robotics, fiber optics and lasers, require basic standards upon which these technologies can be based. These basic standards become the building blocks which form the foundations for those technologies.

The half life of our electronics and computer related technologies is decreasing at an accelerating rate, as shown by the transition from vacuum tubes to very large scale integrated circuits. As the result, increased responsibility is being placed on the standardization community to work closer together with the scientific, engineering and technology communities, in order to develop future standards that are both technology and vendor independent. The laws of "economy of scale" will determine those technologies that should become standards. The impact of computer technology has revolutionized several of the standardization areas within DoD that are documentation intensive. These areas include Technical Manuals, Engineering Drawings and the Computer Areas. The computer software development process is basically a documentation process and, in turn, impacts several other standardization areas. Computer software has become an integral component in areas such as Telecommunications, Electronic Information Processing, Computer Aided Design, Computer Aided Engineering, Computer Aided Manufacturing and new areas such as Computer Aided Logistics Support [10].

Software Documentation Activities

There are numerous contractual documents that address software and firmware documentation within the DoD. These include documents such as Software Quality Assurance Program Requirements (MIL-S-52779A), Configuration Management Practices for Computer Programs (MIL-STD-483). There are also Data Item Descriptions (DIDs) that define the data (i.e., plans, reports, specifications, etc.) to be prepared and delivered by contractors to the Government. In most instances, standards will identify deliverable items of data in connection with the tasks cited in other sections of the standard. In the computer area, there are over 230 DIDs that address computer documentation requirements; many of these result in duplicate, conflicting and obsolete requirements being imposed on defense contractors. These DIDs are being reviewed to combine, eliminate or cancel those DIDs which do not support existing standardization or source document requirements. The distribution of computer software standards and related data item descriptions that have been identified in the Embedded Computer Resources Standards (ECRS) Area Standardization Program Plan as follows:

Distribution of Computer Standards Activities*

Software Area	Standards	DID's
o High Order Languages	5	-
o Instruction Set Architectures	4	-
o Software Design	10	-
o Software Documentation	6	138
o Software Quality	11	23
o Software Reliability	7	-
o Software Configuration Management	7	46
o Software Acquisition Management	5	17
o Terms/Definitions/Misc.	7	-
Total	62	224

*Embedded Computer Resources Standards Area

Within DoD, several software documentation standards have evolved over the years. These standards have been developed by separate communities within the services. They include the following:

- o DOD-STD-7935, DoD Automated Data Systems Documentation Standards
- o DOD-STD-1679A, Software Development
- o MIL-STD-1644, Trainer System Software Engineering Requirements
- o MIL-STD-490, (Type B5), Computer Program Development Specification
- o MIL-STD-483, Configuration Management Practices for Systems, Equipment, Munitions and Computer Programs (Appendix VI Computer Program Configuration Item Specification)
- o Air Force Regulation 800-14, Acquisition and Support Procedures for Computer Resources in Systems
- o MIL-STD-SDS, (Proposed) Defense System Software Development Standard
- o IEEE-STD-829-1983, Standard for Software Test Documentation

Efforts are currently underway to consolidate and combine many of these service unique documentation requirements into a fully coordinated DoD Standard for mission-critical application in the proposed MIL-STD-SDS. [11] The new standard would then supersede and cancel the Navy's DOD-STD-1679A and MIL-STD-1644, as well as modify the requirements in MIL-STD-490, MIL-STD-483 and MIL-STD-1521 to reference MIL-STD-SDS.

SOFTWARE DOCUMENTATION ASSESSMENT

Software documentation has become a critical component in the weapon system development, deployment, maintenance and logistics processes. It is important that management supports our standardization initiatives to reduce and consolidate the numerous software documentation standards and DID's. In order to establish standards that are widely accepted in this dynamic area of technology, it will require close working relationships both within the Government and with industry.

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[3] ANSI/MIL-STD-1815A-1983, "Ada Programming Language," January 22, 1983. ANSI adopted this standard on February 17, 1983. Ada is a trademark of the U.S. Department of Defense.

[4] The Under Secretary of Defense Memorandum, "Interim DoD Policy on Computer Programming Languages," June 20, 1983.

[5] Software Technology for Adaptable, Reliable Systems (STARS) Program Strategy, Department of Defense, 15 March 1983.

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[7] Strategic Computing, New-Generation Computing Technology: A Strategic Plan for its Development and Application to Critical Problems in Defense, Defense Advanced Research Projects Agency, 28 October 1983.

[8] The Paperwork Reduction Act of 1980, Public Law 96-511, 11 December 1980.

[9] DoD 5000.19-L, Volume II, Acquisition Management Systems and Data Requirements Control List (AMSDL), 31 July 1983.

[10] Joint memorandum from Assistant Secretary of Defense (Manpower, Installations and Logistics) and Under Secretary of Defense (Research and Engineering), "DoD Strategy for Development of An Integrated Computer Aided Logistic Support Capability," 19 April 1984.

[11] MIL-STD-SDS (Proposed), Defense System Software Development, 5 December 1983.

DOD-STD-7935 AUTOMATED DATA SYSTEMS (ADS)

DOCUMENTATION STANDARDS

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INTRODUCTION

The accelerated changes in technology are forcing all of us to reexamine the management, control, and documentation of our computer resources. In the world of management information systems (MIS) or automated data systems (ADS) a wide variety of changes in both hardware and software are being examined by the Information Processing Standards for Computers (IPSC) 0061 committee for inclusion in DOD-STD-7935 to enhance the structure of the recent edition which included provisions for documenting online, terminal-driven systems.

The following paragraphs will provide a brief description of DOD-STD-7935 for those of you who may not be familiar with it.

OVERVIEW OF THE STRUCTURE OF DOD-STD-7935

There are three separate parts to the standard as shown in Figure 1. Part 1 provides information about the scope, applicability and objective of the standard. Part 2 discusses guidelines for documentation development. Part 3 contains the detailed outlines and descriptive information about the 11 document types in this system.

HIGHLIGHTS OF DOCUMENTATION DEVELOPMENT GUIDELINES

This documentation system is built around the ADS development life cycle shown in Figure 2 as extracted from DODD 7920.1, Life Cycle Management of Automated Information Systems (AIS). Also shown in Figure 2 are the different document types that may be produced during the different phases of the life cycle.

There are many factors that influence what documents need to be prepared during the development effort. These must, of course, be determined early in the planning phase to specify in the Contract Data Requirements List (CDRL). Figures 3 and 4 show a guide included in Part 2 that can be used to help a project manager determine which document types will be needed for the complexity of the system being developed.

1 The views expressed are those of the author and do not necessarily represent those of any DOD activity.

DOD-STD-7935

PART 1 - GENERAL

SECTION 1. INTRODUCTION

SECTION 2. ORGANIZATION AND NUMBERING SYSTEM

PART 2 - DOCUMENTATION DEVELOPMENT GUIDELINES

SECTION 1. INTRODUCTION

SECTION 2. ADS PROJECT ENVIRONMENT/DOCUMENTATION SYSTEM

SECTION 3. MANAGEMENT OPTIONS IN DOCUMENTATION SYSTEM

PART 3 - DOCUMENTATION STANDARDS

SECTION 1. INTRODUCTION

SECTION 2. DESCRIPTION OF DOCUMENT TYPES

FIGURE 1. Contents of DOD-STD-7935

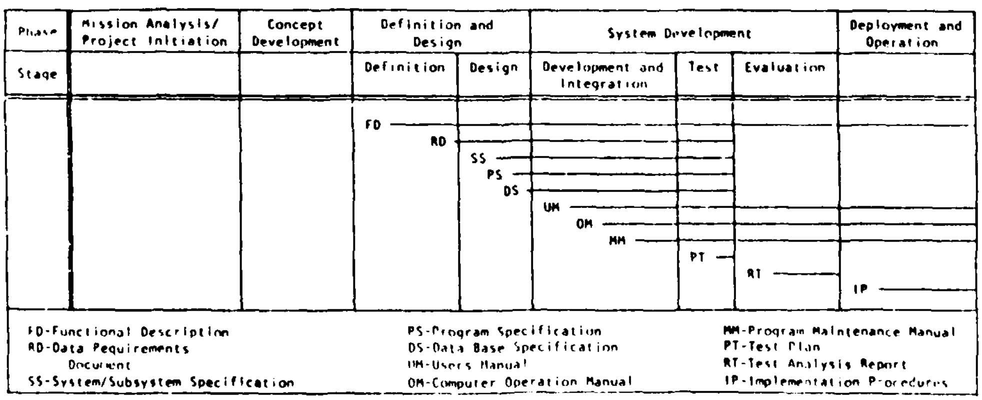


FIGURE 2. Life Cycle/Document Types

COMPLEXITY / FACTORS	1	2	3	4	5
1 ORIGINALITY REQUIRED	NONE. REPROGRAM ON DIFFERENT EQUIPMENT	MINIMUM. MORE STRINGENT REQUIREMENTS	LIMITED. MORE ENVIRONMENT. NEW INTERFACES	CONSIDERABLE. APPLY EXISTING STATE OF ART TO ENVIRONMENT	EXTENSIVE. REQUIRES ADVANCE IN STATE OF THE ART
2 DEGREE OF GENERALITY	HIGHLY RESTRICTED SINGLE PURPOSE	RESTRICTED PARAMETERIZED FOR A RANGE OF CAPACITIES	LIMITED FLEXIBILITY. ALLOWS SOME CHANGE IN FORMAT	MULTI PURPOSE FLEXIBLE FORMAT RANGE OF SUBJECTS	VERY FLEXIBLE ABLE TO HANDLE A BROAD RANGE OF SUBJECT MATTER ON DIFFERENT EQUIPMENT
3 SPAN OF OPERATION	LOCAL OR UTILITY	COMPONENT COMMAND	SINGLE COMMAND	MULTI COMMAND	DEFENSE DEPARTMENT WORLD WIDE
4 CHANGE IN SCOPE AND OBJECTIVE	NONE	INFREQUENT	OCCASIONAL	FREQUENT	CONTINUOUS
5 EQUIPMENT COMPLEXITY	SINGLE MACHINE ROUTINE PROCESSING	SINGLE MACHINE ROUTINE PROCESSING. EXTENDED PERIPHERAL SYSTEM	MULTI COMPUTER STANDARD PERIPHERAL SYSTEM	MULTI COMPUTER ADVANCED PROGRAMMING. COMPLEX PERIPHERAL SYSTEM	MASTER CONTROL SYSTEM. MULTI COMPUTER. AUTO INPUT OUTPUT AND DISPLAY EQUIPMENT
6 PERSONNEL ASSIGNED	1 2	[illegible] 5	5 10	10 18	18 AND OVER
7 DEVELOPMENTAL COST	1 15K	15 70K	70 200K	200 500 K	OVER 500 K
8 CRITICALITY	DATA PROCESSING	ROUTINE OPERATIONS	PERSONNEL SAFETY	UNIT SURVIVAL	NATIONAL DEFENSE
9 AVERAGE RESPONSE TIME TO PROGRAM CHANGES	2 OR MORE WEEKS	1 2 WEEKS	3 7 DAYS	1 3 DAYS	1 24 HOURS
10 AVERAGE RESPONSE TIME TO DATA INPUTS	2 OR MORE WEEKS	1 2 WEEKS	1 7 DAYS	1 24 HOURS	0 60 MINUTES
11 PROGRAMMING LANGUAGES	HIGH LEVEL LANGUAGE	HIGH LEVEL AND LIMITED ASSEMBLY LANGUAGE	HIGH LEVEL AND EXTENSIVE ASSEMBLY LANGUAGE	ASSEMBLY LANGUAGE	MACHINE LANGUAGE
12 CONCURRENT SOFTWARE DEVELOPMENT	NONE	LIMITED	MODERATE	EXTENSIVE	EXHAUSTIVE
TA[illegible]	x 1 =	x 2	x 3 =	x 4 =	x 5 =
					COMPLEXITY TOTAL

FIGURE 3. Project Complexity Chart

Complexity Total	Document Types			
12 - 15			UM	
12 - 26			UM OM MM	PT
24 - 38	FD		UM OM MM	PT
36 - 50	FD	SS	UM OM MM	PT RT
48 - 60	FD	SS PS	UM OM MM	PT RT

Notes:

1. Preparation of the Data Requirements Document, the Data Base Specification, and the Implementation Procedures is situationally dependent.
2. Additional document types may be required at lower complexities.

Abbreviations:

FD-Functional Description	OM-Computer Operation Manual
SS-System/Subsystem Specification	MM-Program Maintenance Manual
PS-Program Specification	PT-Test Plan
UM-Users Manual	RT-Test Analysis Report

FIGURE 4. Project Complexity Related to Document Types

Stressed in the standard and by the implementors is the need for the manager's active involvement in the planning process for the documentation. The standard attempts to encourage preparing adequate, useable documentation and to discourage over-documenting. The manager needs to consider the level of education and technical expertise of the readers, the mix of the developers between government employees and contractors, and the type of hardware/software that will be used ranging from batch processing to desk-top, isolated terminals. All of these factors (and more) influence the quantity and approach used for preparing the technical documentation.

HIGHLIGHTS OF THE DOCUMENTATION STANDARDS

There are 11 different document types within the standard. Figure 5 shows a page from one of the document types.

Each of the document types is presented in a different figure. Each document type is complete in that the figure starts with a Table of Contents and List of Figures and then shows the text of the document. The paragraph numbers and titles shown are the same as those that will be in the final document.

The format used with decimal paragraph numbers, indented itemization, footnotes, etc. is consistent within the standard but is not a required part of the deliverable. Each implementing service/agency can specify a different format if desired. Most have, however, simply followed this format since it does conform with many typing rules such as those for correspondence as well as MIL-STD-962.

FUTURE PLANS

The standard was developed using generic terms such as input, output, process, data base, program, system, etc. This made the standard useful across all services and agencies and for all hardware and software.

Now some of these areas have become unclear due to significant changes in technology. Some of these areas need to be clarified by making changes to the document type standards; others can be addressed by discussing them in Part 2, the Development Guidelines.

INPUT/OUTPUT. There is confusion between "input" and "output." A screen format that is to be used as a data collection form for input from a terminal is actually "output" from the program. The readers of the Users Manual would not expect to find information about how to call that screen under system outputs. They would expect to find that information as the first step under "how to enter data."

SECTION 2. SYSTEM SUMMARY

This section shall provide a general description, written in non-ADP terminology, of the existing system and of the requirements for the proposed ADS.

2.1 Background. Included within this paragraph, as necessary, will be any information concerning the background of the uses and purposes of the system to orient the reader. Reference must be made to higher order and parallel systems when needed to enhance the general description. The relationships between the project and other capabilities being developed concurrently shall be described.

2.2 Objectives. Statements of the major performance requirements and goals of the proposed computer program system must be included. These statements should be concise, quantified if possible, and may include examples. When applicable, related events, such as exercises or impending military operations, may be discussed. Any anticipated operational changes that will affect the system and its use shall be identified and the provisions within the system for including them shall be explained.

2.3 Existing Methods and Procedures. This paragraph shall provide a brief description of the current methods and procedures being employed to satisfy the existing information requirements. A chart must be provided depicting the existing data flow through the functional system from data acquisition through its processing and eventual output. This chart may be complemented by an explanation or another chart showing the sequence in which the operational functions are performed by the user and pointing out the support of those decision making activities that is provided by the present system. Additionally, at least the following information should be included in this description:

a. Organizational/personnel responsibilities.

b. Equipment being utilized.

c. Inputs and outputs including volume and frequency.

d. Deficiencies, including limitations, such as time delays.

2.4 Proposed Methods and Procedures. A description of the proposed methods and procedures shall be presented in this and the following paragraphs. This description, written in non-ADP terminology, should explain how the proposed system will interact with the functional processes of which the automated system will

2

FIGURE 3-31. Functional Description

FIGURE 5. Sample Page from Functional Description

PROGRAM DEFINITION. In the days of batch processing, we understood what a program in an application system was. In a terminal-driven system today, we may have, perhaps, 30 different "modules" or "subroutines" to edit screen input. We may have 6 different screens and each of those may call some of the same modules and some unique modules to edit the input. Is this a "program" and if not, how do we document it? Is each module a program? What is the screen?

ONLINE DOCUMENTATION. We have thousands of desk-top computers. Much of the software for them is written including "help" screens, menu selection of available options, modules to be used to train a new user, etc. Does all this information need to be repeated in the Users Manual? How should it be handled in the Program Maintenance Manual?

COMPUTER OPERATOR FUNCTIONS. The terminal user now performs tasks that used to be the responsibility of the computer operator in a batch processing environment. That terminal user now must resolve errors, make printouts, make backup copies of data bases, etc. Should those functions be documented in a Users Manual or in a Computer Operation Manual?

DATA BASE. With the advent of down-loading of data from a large data base for processing on a terminal, we have had questions about how much information on the data that will be processed by this system or subsystem should be included in the documentation of that system or subsystem. Perhaps such information should be included in a single document for the overall data base and referenced from the system or subsystem documentation.

These are some of the areas that IPSC 0061 is addressing. There are provisions in the new (15 February 1983) version of the DOD-STD-7935 that provide for documenting terminal-driven systems but the committee is trying to enhance these and to help new users of the standard. Most of the current users have ways to document systems with the characteristics just identified but the committee wants to address those items specifically so that all users will be documenting these systems in the same way.

CONCLUSION

DOD-STD-7935 is the standard used for documenting MIS, ADS, and non-embedded systems. The committee tries to meet with various users who have problems with or suggestions for the standard. This standard is actively maintained. It has been improved by this type of interaction over its 11 year life as a DOD standard. Our committee looks forward to active involvement with users of the standard to gain the benefit of their experience and ideas.

JOINT LOGISTIC COMMANDER'S

DOD STANDARD SDS

SOFTWARE DEVELOPMENT SPECIFICATION

BY

CAPT. DAVID L. BOSLAUGH, USN

OVERVIEW

- PROBLEM
- JLC ORGANIZATION
- SOFTWARE STANDARDIZATION PROGRAM OBJECTIVE
- DOD STD SDS PACKAGE
- IMPLEMENTATION STRATEGY
- STATUS

PROBLEM

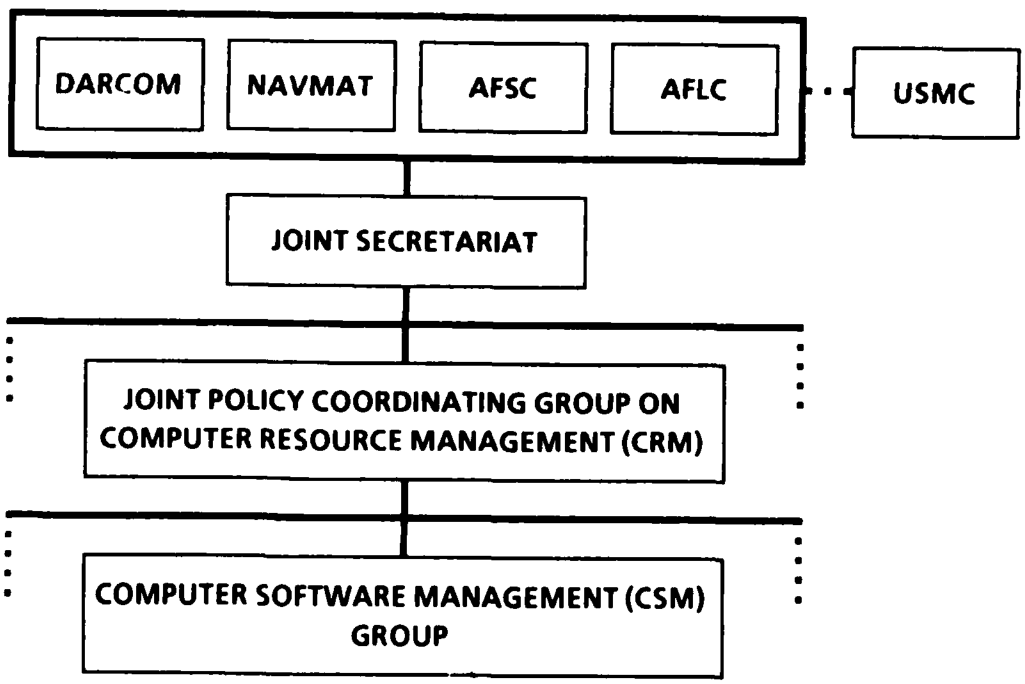
CONFLICTING, REDUNDANT, AND IN SOME CASES, NONEXISTANT SOFTWARE DEVELOPMENT POLICIES AND STANDARDS RESULT IN:

- CONFUSION IN THE PROGRAM OFFICE
- DUPLICATION OF EFFORT
- CONTRACTORS MAINTAINING MULTIPLE MANAGEMENT SYSTEMS
- ADDING UNNECESSARY COSTS TO THE SOFTWARE ACQUISITION PROCESS

MONTEREY I RECOMMENDATIONS
(APRIL 1979)

- DEVELOP A GENERAL POLICY FRAMEWORK FOR THE JOINT SERVICES TO ADDRESS THE ENTIRE SOFTWARE LIFE CYCLE
- DEVELOP A SINGLE UNIFIED SET OF SOFTWARE ACQUISITION AND DEVELOPMENT STANDARDS
- DEFINE AND DEVELOP A COMPREHENSIVE SET OF DIDS
- DEVELOP A METHODOLOGY FOR DETERMINING THE MINIMUM DOCUMENTATION REQUIRED
- DEVELOP POLICY TO REQUIRE USE OF SOFTWARE ACCEPTANCE CRITERIA AT CRITICAL MILESTONES
- IDENTIFY SPECIFIC PROGRAMS FOR THE COLLECTION OF SOFTWARE ERROR DATA

JOINT LOGISTIC COMMANDERS' (JLC) ORGANIZATION



JOINT POLICY COORDINATING GROUP (JPCG) ON COMPUTER RESOURCE MANAGEMENT

• AIR FORCE LOGISTIC COMMAND (AFLC)	LTCOL J. HARRINGTON
• NAVAL MATERIAL COMMAND (NMC)	CAPT D. BOSLAUGH (CHAIRPERSON)
• U.S. ARMY MATERIAL DEVELOPMENT AND READINESS COMMAND (DARCOM)	COL H. ARCHIBALD
• AIR FORCE SYSTEMS COMMAND (AFSC)	COL K. NIDIFFER
• HEADQUARTERS, U.S. MARINE CORPS	MAJ K. PTACK

COMPUTER SOFTWARE MANAGEMENT (CSM) SUBGROUP

• AFLC	D. KVENVOLD
• NMC	LCDR M. GEHL
• DARCOM	C. OGLESBY
• AFSC	CPT L. COOPER

JLC SOFTWARE STANDARDIZATION PROGRAM OBJECTIVE

PRODUCE A COMPLETE, CONSISTENT TRI-SERVICE SET OF ACQUISITION, DEVELOPMENT AND SUPPORT STANDARDS WHICH:

- ESTABLISH A WELL-DEFINED AND EASILY UNDERSTOOD SOFTWARE ACQUISITION AND DEVELOPMENT PROCESS
- PROVIDE ADEQUATE VISIBILITY DURING SOFTWARE DEVELOPMENT AND ACQUISITION
- REDUCE CONFUSION AND ELIMINATE CONFLICTS IN EXISTING STANDARDS
- ARE COMPATIBLE WITH MODERN METHODS OF DEVELOPING SOFTWARE
- PROVIDE COST BENEFITS OVER THE ENTIRE LIFE CYCLE
- INCREASE PROBABILITY OF OBTAINING QUALITY SOFTWARE

SOFTWARE DEVELOPMENT STANDARDIZATION PROJECT

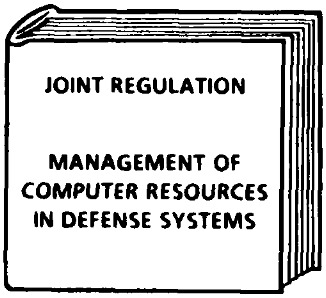
- JOINT REGULATION, MANAGEMENT OF COMPUTER RESOURCES IN DEFENSE SYSTEMS
- DOD-STD-SDS
- TWENTY-FIVE DATA ITEM DESCRIPTIONS (DIDS)
- ASSOCIATED CHANGES TO:
  - MIL-STD-483, CONFIGURATION MANAGEMENT
  - MIL-STD-490, SPECIFICATION PRACTICES
  - MIL-STD-1521A, TECHNICAL REVIEWS AND AUDITS
- TRAINING COURSE AND GUIDEBOOK

CALLED "THE SDS PACKAGE"

JOINT LOGISTICS COMMANDERS POLICY & STANDARDS

POLICY		STANDARD

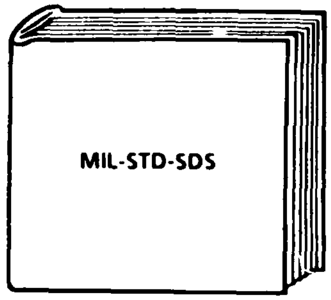
POLICY



- OUTLINES EVOLUTION OF COMPUTER RESOURCES THROUGHOUT SYSTEM ACQUISITION LIFE CYCLE
- DEFINES SOFTWARE DEVELOPMENT CYCLE
  - ACTIVITIES
  - REVIEWS
  - PRODUCTS
  - BASELINES

+

STANDARD

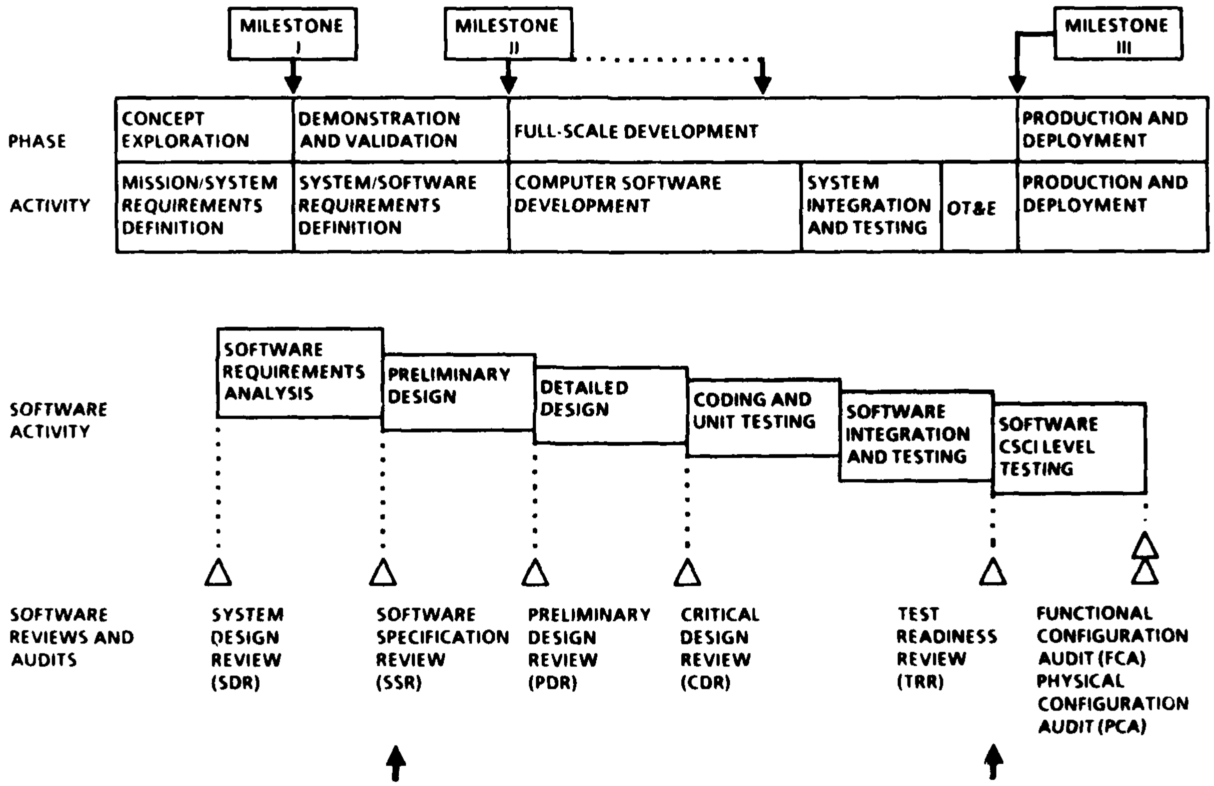


- DEFINES REQUIREMENTS FOR A SOFTWARE DEVELOPMENT CONTRACTOR
- MATCHING DIDs AVAILABLE

DOD-STD-SDS PRECEPTS

- A DISCIPLINED APPROACH TO SOFTWARE DEVELOPMENT IS NEEDED
- PROVEN ENGINEERING AND ACQUISITION MANAGEMENT DISCIPLINES MUST BE APPLIED
- SOFTWARE DEVELOPMENT CAN (AND DOES) OCCUR AT ANY POINT IN THE SYSTEM LIFE CYCLE
- THE DEVELOPMENT AND USE OF MODERN SOFTWARE DEVELOPMENT PRACTICES SHOULD NOT BE CONSTRAINED BY DOD-STD-SDS
- MORE ACCURATE VISIBILITY INTO SOFTWARE DEVELOPMENT STATUS IS NEEDED
- SOFTWARE SUPPORT REQUIREMENTS NEED TO BE DEFINED EARLY AND ACQUIRED

COMPUTER SOFTWARE DEVELOPMENT CYCLE



MAJOR DOD-STD-SDS CHARACTERISTICS

- IS PROCESS ORIENTED, FLEXIBLE AND TAILORABLE
- INTEGRATES SOFTWARE DEVELOPMENT PROCESS INTO OVERALL DEFENSE SYSTEM DEVELOPMENT PROCESS
- ENCOURAGES USE OF INNOVATIVE ACQUISITION TECHNIQUES
- ALLOWS ALTERNATIVE DESIGN METHODOLOGIES
- ENCOURAGES USE OF COMMERCIALLY-AVAILABLE AND REUSABLE SOFTWARE
- REQUIRES USE OF APPROVED SET OF CODING STANDARDS
- REQUIRES USE OF HOL SUCH AS ADA
- EMPHASIZED SOFTWARE SUPPORT REQUIREMENTS THROUGHOUT DEVELOPMENT CYCLE
- REQUIRES COST AND SCHEDULE TRACKING TO THE CSCI LEVEL

IMPLEMENTATION STRATEGY

- ANALYZE EXISTING GUIDANCE AND DRAFT NEW STANDARDS
- ADOPT AN EVOLUTIONARY APPROACH BASED ON EXPERIENCE AND TECHNOLOGY ADVANCEMENTS
- INCLUDE INDUSTRY IN PRELIMINARY AND FINAL REVIEWS
- ESTABLISH AN ISSUE RESOLUTION PROCEDURE
- OBTAIN THE SUPPORT OF OSD AND THE USING COMMANDS
- SUPPORT THE IMPLEMENTATION WITH TRAINING COURSES AND GUIDEBOOKS

DOD-STD-SDS STATUS

- MONTEREY I WORKSHOP — APR 79
- STARTED SDS DEVELOPMENT — APR 81
- INFORMAL GOVERNMENT AND INDUSTRY REVIEW OF DRAFT — JUN-OCT 82
- REVISED DRAFT — APR 83
- JLC, EIA, AIA, AND NSIA WORKSHOPS — MAY-JUL 83
  - OVER 5000 COMMENTS
  - 42 OUTSTANDING ISSUES
- FINAL DRAFT COMPLETED — DEC 83
  - 24 OUTSTANDING ISSUES RESOLVED
  - 10 OUTSTANDING ISSUES PARTIALLY RESOLVED
  - ANALYSIS EFFORT ON 8 OUTSTANDING ISSUES INITIATED
- FORMAL REVIEW/COORDINATION — JAN-MAR 84
  - AFSC COMMENTS SO FAR
    - TWO MAJCOMS - "EXCELLENT PRODUCT, NO PROPOSED CHANGES"
    - HQ AFSC LABS, PLANS, LEGAL, COMPTROLLER, TEST, CONTRACTING, AND INFORMATION SYSTEMS - MINOR CHANGES
- FORMAL REVIEW COMMENTS INCORPORATED — APR-SEP 84
- IMPLEMENTATION — OCT 84
- INITIATE REVISION EFFORT — OCT 84
  - RESOLVE 8 OUTSTANDING ISSUES
  - INCORPORATE FEEDBACK FROM FIELD USE

DOD-STD-SDS STATUS (CONT.)

- PROTOTYPE APPLICATIONS UNDERWAY
  - AFSC/ASD AREA REPROGRAMMING CAPABILITY PROGRAM
  - AFSC/SD CONSOLIDATED SPACE OPERATION CENTER PROGRAM
  - FAA NATIONAL AIRSPACE MANAGEMENT SYSTEM
  - BOEING SOFTWARE STANDARDS MANUAL
  - TEXAS INSTRUMENTS CORPORATE POLICY
- EXTERNAL AGENCIES INTERESTED
  - NASA
  - DLA
  - CIA
  - MITRE (TRIMIS)
- IN USE
  - JOINT SERVICES SOFTWARE ENGINEERING ENVIRONMENT
  - SOFTWARE TEST AND EVALUATION PROJECT
  - FAA NATIONAL AIRSPACE MANAGEMENT SYSTEM

SOFTWARE DOCUMENTATION STANDARDS

DIDs DEVELOPED FOR

- MANAGEMENT PLANS
- ENGINEERING SPECIFICATIONS/DOCUMENTATION
- TEST PLANS/PROCEDURES/REPORTS
- SUPPORT DOCUMENTATION

WILL PROVIDE COMMON DOCUMENTATION SET

SOFTWARE DIDs

ENGINEERING:

SSS	SYSTEM/SEGMENT SPECIFICATION
SRS	SOFTWARE REQUIREMENTS SPECIFICATION
IRS	INTERFACE REQUIREMENTS SPECIFICATION
STLDD	SOFTWARE TOP LEVEL DESIGN DOCUMENT
SDDD	SOFTWARE DETAIL DESIGN DOCUMENT
IDD	INTERFACE DESIGN DOCUMENT
DBDD	DATA BASE DESIGN DOCUMENT
SPS	SOFTWARE PRODUCT SPECIFICATION
SPCR	SOFTWARE PROBLEM/CHANGE REPORT

MANAGEMENT:

CRLCMP	COMPUTER RESOURCES LIFE CYCLE MANAGEMENT PLAN
SDP	SOFTWARE DEVELOPMENT PLAN
SCMP	SOFTWARE CONFIGURATION MANAGEMENT PLAN
SQAP	SOFTWARE QUALITY ASSURANCE PLAN
SSPM	SOFTWARE STANDARDS AND PROCEDURES MANUAL
VDD	VERSION DESCRIPTION DOCUMENT

SOFTWARE DIDs (CONTINUED)

TEST:

STP	SOFTWARE TEST PLAN
STD	SOFTWARE TEST DESCRIPTIONS
STPR	SOFTWARE TEST PROCEDURES
STR	SOFTWARE TEST REPORT

SUPPORT:

CSOM	COMPUTER SYSTEM OPERATOR'S MANUAL
SUM	SOFTWARE USER'S MANUAL
CSDM	COMPUTER SYSTEM DIAGNOSTIC MANUAL
SPM	SOFTWARE PROGRAMMER'S MANUAL
FSM	FIRMWARE SUPPORT MANUAL
OCD	OPERATIONAL CONCEPT DOCUMENT
SPCR	SOFTWARE PROBLEM/CHANGE REPORT

MAJOR DOD-STD-SDS BENEFITS

- PROVIDES COMMONALITY AMONG THE SERVICES
  - REDUCES NUMBER OF SOFTWARE DEVELOPMENT METHODS FROM FOUR TO ONE
  - ALLOWS OSD AND SERVICES TO CANCEL AN ESTIMATED 100 DIDs
- REDUCES COST TO CONTRACTORS AND GOVERNMENT
  - IMPROVES CONTRACTOR PRODUCTIVITY
  - ALLOWS CONTRACTORS TO STANDARDIZE AND AUTOMATE SOFTWARE DEVELOPMENT AND MANAGEMENT PROCESSES
- PROVIDES MORE ACCURATE VISIBILITY INTO SOFTWARE DEVELOPMENT STATUS
- CONTRIBUTES TO EARLY IDENTIFICATION OF SOFTWARE ERRORS
- PROVIDES A DISCIPLINED PROCESS FOR PDSS

Documenting in Ada

Dr. Lawrence Lindley
ECR Program Manager
Naval Avionics Center

Ada Background

Ada Aspects

Language
Compiler
Programmer Support Environment

Ada Goals

Common DoD Programming Language
Programming for Real Time, Embedded Systems
Employ Modern Software Engineering Techniques
Suitable for Development of Large Programs
Facilitate Reliability and Maintainability

Ada History

HOLWG formed	Jan 75
Strawman	Apr 75
DODD 5000.29/DODI 5000.31	Apr 76/Nov 76
Language RFP	Apr 77
Steelman	June 78
Selection of Green Language	Apr 79
Stoneman	Feb 80
MIL-STD-1815	Dec 80
MIL-STD-1815A	Feb 83
Validated Comm Compiler	June 83

Ada Future

DeLauer Letter
DODD 3405.xx
ALS
CAIS
SEE
Methodologies

Ada for Documentation

Ada Features For Documentation

- NAMING RULES
- TYPE DEFINITIONS AND CONVERSION
  - subtypes
  - derived types
  - enumeration type
  - range specification
  - error bounds
  - explicit type conversion
- PARAMETER LISTS
  - mode
  - named association
- PACKAGES
  - package specs
  - use clauses
  - with clauses
- EXCEPTIONS

```
package EXAMPLE is
   with ANOTHER_PACKAGE;
   use ANOTHER_PACKAGE;
   type DAY is (SUN,MON,TUE,WED,THR,FRI,SAT);
   type EXPL_INTEGER is range 1 . . 100;
   type EXPL_FLOAT_PT is digits 10 range -1.0 . . 1.0;
   type EXPL_FIX_PT is delta 0.1 range 0.0 . . 100.0;
   subtype SUB_EXPL_INTEGER is EXPL_INTEGER range 1 . . 50;
   procedure FIRST_PROC (PARAM_1: in REAL ; PARAM_2 : in out INTEGER);
   ERROR_1 : exception;
end EXAMPLE;

package body EXAMPLE is
   procedure FIRST_PROC (PARAM_1 : in REAL ; PARAM_2 : in out INTEGER);
      VAR 1 : EXPL_INTEGER;
   begin
      . . .
   exception
      . . .
   end FIRST_PROC;
end EXAMPLE;
```

Requirements Analysis	Preliminary Design	Detailed Design	Code Unit Testing	Integration Testing	CSCI-Level Testing

DOD-STD-SDS Software Development Cycle

Requirements Analysis

Software Requirements Specification
Interface Requirements Specification
Identify Functions:
- Inputs
- Processing
- Outputs

Identify Interfaces:
- CSCI/CSCI
- HWCI/CSCI

Requirements Languages and Tools

Preliminary Design

Top Level Design Document
Define High Level Modularity:
- Inputs
- Local Data
- Processing
- Outputs

Requirements Language/Program Design Language

Detailed Design

Detailed Design Document
Interface Design Document
Data Base Design Document
Define, to lowest level:
- Modularity
- Processing
- Internal data
- Shared data
- Interfaces

Program Design Language

Ada Based Program Design Language

Ada PDL Purpose

Low Level Data and Control Structure Design
Data and Control Structure Documentation
Simplification of the Transition from Design to Code

Ada PDL Development

AdaTEC Design Methodology Subgroup
IEEE Ada as a PDL Working Group
Ada PDL Survey, October, 1982

PROBLEM: COMPUTE $\sqrt{Y}$

SOLUTION: X_1 = initial value

$X_2 = (X_1 + Y/X_1) / 2$

$X_3 = (X_2 + Y/X_2) / 2$

...

until $X_{n+1} = X_n$ (approx)

PDL

```
proc SQRT ( fix Y : real , alt X : real )
   XT : array
   initialize XT(0)
         [based on y]
while
   XT(I) not convergent
do
   XT(I+1) := (XT(I) + Y / XT(I) ) / 2
         [compute next approximation]
         [increment I]
od
   X := XT(I)
corp
```

Ada PDL

```
        procedure SQRT ( Y : in REAL ; X : out REAL ) is
           XT : array (1 . . TBD) of REAL;
        begin
--         initialize XT(0)
              -- based on Y
--      while
--         XT(I) not convergent
--      loop
--        XT(I+1) := (XT(I) + Y / XT(I) ) / 2;
--              -- compute next approximation
--        increment I
--      end loop
           X := XT(I);
        end SQRT;
```

Ada PDL Issues

Design in Ada PDL, code in another language
Compilability
PDL implementation of full language
Distinction between design and code

Ada Documentation Issues

Ada oriented documentation standards
Automated documentation tools
Ada requirements languages
Relationship to methodologies

A DECADE OF SUCCESS

IN

COMPUTER AIDED DESIGN

BY

CURTIS P. BAUER

BACKGROUND

THE EDGEWOOD AREA OF ABERDEEN PROVING GROUND HAS BEEN INVOLVED WITH USING COMPUTERS TO SOLVE ENGINEERING PROBLEMS FOR MANY YEARS. THE CAD EFFORTS BEGAN IN 1971 WHEN AN AUTOMATED DRAFTING AND DIGITIZING SYSTEM WAS MADE OPERATIONAL. THEN IN 1974 OUR FIRST INTERACTIVE GRAPHICS SYSTEM WAS INSTALLED AND A SECOND STATION ADDED IN 1975, GROWING TO A TOTAL OF EIGHT CAD STATIONS TODAY. CONCURRENTLY DURING THAT PERIOD, PERIPHERALS WERE ADDED; HIGH SPEED DRUM PLOTTER, COMPUTERIZED OUTPUT MICROFILM (COM), DISK STORAGE INCREASED FROM AN INITIAL 10 MEGABYTES TO 600 MEGABYTES, 3-AXIS DIGITIZER, MAG TAPE UNITS, ETC., TO OUR PRESENT CONFIGURATION TODAY.

INTRODUCTION

IT IS COMMON KNOWLEDGE THAT COMPUTER AIDED DESIGN/DRAFTING (CAD) SYSTEMS ARE VERY COST-EFFECTIVE AND HIGHLY PRODUCTIVE. THE POWER OF THE COMPUTER HAS RAPIDLY BECOME AN INTEGRAL PART OF THE ENGINEERING COMMUNITY FOR BOTH PRIVATE INDUSTRY AND GOVERNMENT. THIS ADVANCED COMPUTER TECHNOLOGY IS BEING EMPLOYED TO COMBAT SPIRALING COSTS, DEVELOP BETTER AND MORE RELIABLE ITEMS, THROUGH INCREASED DESIGN LATITUDE, AND DRASTICALLY REDUCED LEAD TIME. THE PRESENT AND FUTURE OF CAD TECHNOLOGY CAN BEST BE DESCRIBED BY QUOTING THE TITLE FROM A POPULAR SONG SUNG AT MANY WEDDINGS, "WE'VE ONLY JUST BEGUN."

SUCCESS DIDN'T COME EASY, IT WAS A LONG HARD STRUGGLE. FOR EXAMPLE: SHORTLY AFTER OUR INITIAL CAD STATION WAS INSTALLED A BRANCH CHIEF REMARKED THAT THE CAD SYSTEM WOULD NEVER BE ABLE TO PRODUCE A LEVEL III PRODUCTION ENGINEERING DRAWING. ALSO, DURING ONE OF OUR DEMONSTRATIONS, AN ENGINEER SAID "THAT (CAD SYSTEM) WILL NOT DO ANYTHING I CAN'T DO ON THE BOARD." WITH THAT CHALLENGE WE SET TO WORK. APPROXIMATELY ONE YEAR LATER WE WERE ABLE TO PRODUCE A PRODUCTION ENGINEERING DRAWING AND IT WAS BOLDLY HUNG ON THE BRANCH CHIEF'S OFFICE WALL, AND THE ENGINEER WHO COULD DO THE SAME ON THE DRAFTING BOARD, IS NOW ONE OF OUR BEST CUSTOMERS.

I RELATE THIS STORY TO SHOW THE DISBELIEF THAT EXISTED THEN AND STILL EXISTS TODAY TO A LESSER DEGREE. WHAT IS COMMONPLACE TODAY EITHER DID NOT EXIST, OR WAS VERY DIFFICULT TO PERFORM A DECADE AGO. SIMPLE LINES AND CIRCLES COULD NOT BE MODIFIED; THEY HAD TO BE DELETED AND NEW LINES AND CIRCLES CONSTRUCTED. MOST GEOMETRIC MODIFIERS WERE UNAVAILABLE AND RESPONSE TIME WAS SLOW. THIRTY-TWO K MEMORY AND 30 MEGABYTE DISKS WERE CONSIDERED LARGE.

TODAY

AT PRESENT CRDC IS USING THE CAD UNIT TO ITS FULL CAPABILITY RESULTING IN SOME AMAZING COST REDUCTIONS, TIME SAVINGS AND QUICK TURN-AROUND. FOR EXAMPLE, NEW DRAWINGS COST 30% LESS, AND REVISIONS HAVE A SAVINGS OF APPROXIMATELY 7 TO 1. WITH A YEARLY THROUGHPUT OF HUNDREDS OF NEW DRAWINGS THE COST SAVINGS EMPLOYING CAD ARE ENORMOUS.

ENOUGH ON DOLLAR SAVINGS, I AM SURE YOU HEARD IT BEFORE MANY TIMES. INSTEAD I WOULD LIKE TO TAKE THIS TIME TO TALK ABOUT OTHER BENEFITS AND PROBLEMS WITH CAD SYSTEMS.

OTHER BENEFITS.

1. HANDICAPPED. WE HAVE FOUND THE CAD SYSTEMS OPEN ANOTHER DOOR FOR EMPLOYMENT OF THE HANDICAPPED. PEOPLE CONFINED TO WHEELCHAIRS CAN EASILY FUNCTION AT A CAD WORK-STATION. ALSO, PEOPLE WITH THE USE OF ONLY ONE ARM CAN BE EFFICIENT AND PRODUCTIVE WITH THE USE OF A CAD SYSTEM. HANDICAPPED HAVE AN EXCELLENT REPUTATION FOR BEING GOOD PRODUCTIVE EMPLOYEES, ANOTHER SOURCE FOR EMPLOYERS TO DRAW UPON.

2. QUALITY. WE HAVE ALL BEEN EXPOSED TO THE UNREADABLE DRAWING - IS IT A 6 OR 5, 8 OR 0, OR SO ON. WITH CAD ALL DRAWINGS ARE EITHER OUTPUT ON A PLOTTER OR COM UNIT WITH EXCELLENT LEGIBILITY AND MICROFILM QUALITY. BLUELINE REPRODUCTION IS ALSO EXCELLENT, WHEN WET INK IS USED IN THE PLOTTER.

3. LOST OR DAMAGED ORIGINALS. DURING MY CAREER I HAVE SPENT MANY HOURS SEARCHING FOR THE LOST ORIGINAL, ONLY TO BE FOUND AFTER SPENDING HOURS REDRAWING THE LOST DRAWING. COFFEE AND SODA HAVE ALSO BEEN RESPONSIBLE FOR REDRAWING AT GREAT COST. WITH A CAD SYSTEM A NEW ORIGINAL CAN BE GENERATED IN A MATTER OF MINUTES. RETRIEVE THE DAMAGED DRAWING DATA FROM THE STORAGE DEVICE AND GENERATE A NEW ORIGINAL DRAWING ON THE PLOTTER.

4. STORAGE SPACE. THERE NEVER SEEMS TO BE ENOUGH STORAGE SPACE AT WORK, AND AT HOME. WITH A CAD SYSTEM THERE REALLY IS NO NEED TO STORE ORIGINAL DRAWINGS, AFTER ALL THEY CAN BE RETRIEVED QUICKLY FROM THE SYSTEM. IF YOU ARE FORTUNATE ENOUGH TO HAVE A COM DEVICE YOU REALLY DON'T NEED HARD COPIES AT ALL.

SAVES A LOT OF PAPER AND LABOR NEEDED FOR FILING AND MAINTAINING MANUAL DRAWING FILES, PLUS YOU ALWAYS HAVE YOUR MICROFILM FILE FOR EVERYDAY USE.

5. MORE EFFICIENT DESIGN. THERE IS NO QUESTION IN MY MIND THAT CAD SYSTEM USAGE RESULTS IN BETTER DESIGN. SINCE DETAILS, VIEWS, ETC., CAN EASILY BE MANIPULATED, MOVED AND SCALED, ETC., WITH NO ERASING, THE DESIGNER WILL EXAMINE MANY MORE ALTERNATES FOR HIS DESIGN. THIS WILL RESULT IN A MORE EFFICIENT AND ~~LESS~~ COSTLY OVER DESIGN.

6. BOM & PL GENERATION. MOST CAD SYSTEMS HAVE FACILITIES TO AUTOMATICALLY GENERATE A BILL OF MATERIAL (BOM) AND PARTS LIST(PL). NOT ONLY IS THIS A TREMENDOUS TIME SAVER, BUT RESULTS IN FAR GREATER ACCURACY. IT IS QUITE LABORIOUS TO COUNT SMALL ITEMS SUCH AS NUTS, BOLTS, WASHERS, ETC., ON BOTH LARGE AND SMALL ASSEMBLIES.

CAD SYSTEM PROBLEMS.

NO MATTER HOW GOOD SOMETHING IS, IT SEEMS THAT IT ALSO HAS SOME DISADVANTAGES. THIS IS ALSO THE CASE WITH CAD SYSTEMS. MOST VENDORS AND EVEN SOME USERS TRY TO SWEEP THESE PROBLEMS UNDER THE RUG.

LET'S EXAMINE SOME OF THE PROBLEMS THAT STILL EXIST TODAY IN VARYING DEGREES.

1. ARCHIVAL DRAWINGS. WHAT DO YOU DO WITH THE THOUSANDS OF EXISTING ACTIVE MANUAL DRAWINGS? HOW DO YOU GET ALL THAT VALUABLE DATA INTO YOUR CAD SYSTEMS? WELL, THERE REALLY IS NO SIMPLE QUICK, LOW COST ANSWER TO THAT PROBLEM TODAY. ALL NEW DRAWING REQUIREMENTS ARE SATISFIED WITH THE CAD SYSTEM, BUT

WHAT ABOUT REVISIONS TO EXISTING MANUALLY PREPARED DRAWING PACKAGES?

THE APPROACH WE HAVE TAKEN IS DIGITIZING ON DEMAND. SMALL REVISIONS TO EXISTING MANUAL DRAWINGS ARE STILL BEING ACCOMPLISHED IN A MANUAL MODE. THE DIGITIZING COST IS TOO HIGH TO JUSTIFY FOR MINOR UPDATES.

IF THE UPDATE IS OF A MORE COMPLEX NATURE, BUT STILL NOT MASSIVE, IN-HOUSE DIGITIZING IS USED. BUT WHAT ABOUT DRAWING PACKAGES CONTAINING MORE THAN 100 DRAWINGS WITH 80% OF THE DRAWINGS REQUIRING VARIOUS DEGREES OF REVISIONS? IN SUCH A CASE WE HAVE FOUND OUTSIDE CONTRACTING TO BE THE MOST EFFICIENT, QUICK TURN-AROUND, ACCURATE AND REASONABLE COST. WE HAVE FOUND THAT THE AVERAGE COST FOR CONTRACT DIGITIZING IS $75.00 PER DRAWING. CONSIDERING THAT MY IN-HOUSE HOURLY RATE IS APPROXIMATELY $40.00 PER HOUR, THAT WOULD MEAN I WOULD HAVE TO COMPLETELY DIGITIZE A DRAWING ON AN AVERAGE OF ONE HOUR AND 52 MINUTES. I FIND THIS TO BE A RATHER IMPOSSIBLE TASK. DOES THIS MEAN THAT CONTRACTORS ARE ACTUALLY DIGITIZING THESE DRAWINGS IN LESS THAN TWO HOURS EACH? OF COURSE NOT. THEN HOW ARE THEY ABLE TO PERFORM THE TASK AT THAT PRICE? THE ANSWERS ARE RELATIVELY SIMPLE. FIRST AND FOREMOST, THEY ARE GENERALLY SMALL JOB SHOP HOUSES WITH LOW OVERHEAD. MANY HIRE VOCATIONAL TECHNICAL SCHOOL AND COLLEGE STUDENTS ON A TEMPORARY BASIS USING SECOND AND THIRD SHIFTS, THEREBY GREATLY REDUCING THEIR LABOR RATE. SINCE THEY ARE ONLY COPYING DRAWINGS, ENGINEERING EXPERTISE IS NOT REQUIRED.

ON THE SURFACE THIS MAY APPEAR LIKE THE JOB SHOPS ARE TAKING ADVANTAGE OF THESE STUDENTS. QUITE THE OPPOSITE, THE STUDENTS ARE GAINING INVALUABLE EXPERIENCE ON A CAD SYSTEM, AND AS WE WILL ALL AGREE, THERE IS A DEFINITE SHORTAGE OF EXPERIENCED CAD OPERATORS. CONSEQUENTLY, EVERYONE IS GAINING FROM THIS VENTURE. WE ARE GETTING DRAWING PACKAGES INTO OUR CAD SYSTEM AT A LOW COST, THE JOB SHOPS ARE MAKING MONEY AND THE STUDENTS HAVE A PART-TIME JOB GAINING VALUABLE CAD EXPERIENCE.

AUTOMATIC SCANNING.

MUCH HAS BEEN SAID ABOUT AUTOMATIC SCANNING (DIGITIZING). I AM CONVINCED IT WILL HAPPEN IN THE NEAR FUTURE, BUT NOT PRESENTLY AVAILABLE.

RASTER SCANNING A DRAWING OR MICROFILM IS PRESENTLY AVAILABLE WITH AMPLE ACCURACY. BUT CONVERTING RASTER DATA TO INTELLIGENT VECTOR DATA HAS NOT BEEN ACCOMPLISHED TO DATE. FOR EXAMPLE: (1) CONVERTING A RASTER CIRCLE TO A TRUE CIRCULAR INTERPOLATED CIRCLE, (2) LOCATING START POINT AND END POINTS OF LINES, (3) INTERPRETING VARIOUS THICKNESS OF LINES.

ALPHA-NUMERICS PRESENT AN EVEN MORE CHALLENGING PROBLEM. EVEN IF WE WERE ABLE TO CONVERT RASTER TEXT TO SHORT STUBBY VECTORS, IT WOULD BE VIRTUALLY UNUSABLE. THE SYSTEM WOULD NOT RECOGNIZE IT AS TEXT AND ALL THE DATA STORAGE REQUIRED FOR THE

SHORT STUBBY VECTORS WOULD BE ENORMOUS. RECOGNIZE HOW MANY STUBBY VECTORS WOULD BE REQUIRED JUST TO DISPLAY THE LETTER "B". THEREFORE, TEXT RECOGNITION IS REQUIRED. WHY NOT USE OPTICAL CHARACTER RECOGNITION? AFTER ALL IT IS BEING USED QUITE SUCCESSFULLY IN WORD PROCESSING TODAY. THE DIFFERENCE IS THE OCR'S EXPECT TO SEE CLEAN WELL-FORMED TEXT WITH A LIMITED AMOUNT OF FONTS. OLD MANUALLY PREPARED DRAWINGS CONTAIN VARIOUS SIZES, FONTS AND STYLES, VERTICAL LETTERING, SLANTED LETTERS, AND TEXT IMBEDDED IN DIMENSIONS. TO DATE I KNOW OF NO SYSTEM THAT CAN SOLVE ALL OF THE ABOVE PROBLEMS.

THE PROBLEM OF NOT BEING ABLE TO ECONOMICALLY COMMIT MANUALLY PREPARED DRAWINGS TO A CAD SYSTEM IS ONE OF THE THREE MOST SIGNIFICANT PROBLEMS CONFRONTING CAD SYSTEMS TODAY. THE OTHER TWO ARE USER ACCEPTANCE AND DATA TRANSFER AMONG VENDORS.

DATA TRANSFER.

THIS PROBLEM IS ACTIVELY BEING ADDRESSED TODAY WITH MUCH SUCCESS. THERE ARE MANY TRANSLATE PROGRAMS BEING PROMOTED TODAY. I FEEL THAT IGES (INITIAL GRAPHIC EXCHANGE SPECIFICATION) IS THE EXCHANGE SPECIFICATION THAT WILL BECOME THE INDUSTRY STANDARD FOR DATA EXCHANGE. IT SHOWS GREAT PROMISE, AND HAS BEEN

PUBLICLY DEMONSTRATED ON NUMEROUS OCCASIONS WITH ATTRACTIVE SUCCESS. I AGREE IT IS FAR FROM BEING PERFECT AND NEEDS MUCH ENHANCEMENT AND SPEED-UP BUT AM CONVINCED IT WILL PREVAIL.

THE NEED FOR RAPID ACCURATE DATA TRANSFER BETWEEN DIFFERENT BRANDS OF SYSTEMS IS IMPERATIVE, AND MUST BE ACCOMPLISHED WITH OFF-THE-SHELF SOFTWARE SUCH AS IGES. SYSTEM INCOMPATIBILITY HAS BEEN A HANDICAP TO ME FOR A LONG TIME. FOR EXAMPLE:

1. MOST OF OUR LARGE TECHNICAL DATA PACKAGES (TDP) ARE DEVELOPED ON CONTRACT. UPON COMPLETION OF THE CONTRACT, IT IS OUR RESPONSIBILITY TO MAINTAIN THIS TDP. THE MAJORITY OF THE LARGE CONTRACTORS TODAY ARE DEVELOPING THE TDP ON A CAD SYSTEM. BUT, DUE TO INCOMPATIBILITY THESE TDP'S ARE DELIVERED ON HARD COPY, SINCE OUR SYSTEMS ARE INCOMPATIBLE. IN ORDER TO TAKE ADVANTAGE OF OUR CAD - I'M REQUIRED TO HAVE THE NEW TDP DIGITIZED. THIS IS A TREMENDOUS WASTE OF TIME AND MONEY.

WOULDN'T IT BE NICE IF COMPATIBILITY EXISTED AND TDP'S COULD BE DELIVERED ON A ROLL OF MAGNETIC TAPE. UNFORTUNATELY TODAY, THE ONLY TIME THAT THIS CAN BE ACCOMPLISHED IS WHEN THE CONTRACTOR AND CRDC HAVE COMPATIBLE SYSTEMS.

I AM SURE THAT I AM NOT THE ONLY ONE THAT SUFFERS WITH THIS PROBLEM. FOR THIS REASON I AM CONVINCED THAT A COMMON TRANSLATE PROCEDURE IS IMPERATIVE AND IS ON THE IMMEDIATE HORIZON.

2. EARLIER I MENTIONED ABOUT CONTRACTING FOR DIGITIZING OLD MANUALLY PREPARED DRAWINGS. BECAUSE OF THE SYSTEM INCOMPATIBILITY PROBLEMS, MY SOURCE OF POTENTIAL CONTRACTOR'S ~~SOURCE~~S IS LIMITED TO VENDORS WITH THE SAME SYSTEM. CERTAINLY NOT AN IDEAL SITUATION.

CONCLUSION.

I WOULD LIKE TO THANK YOU FOR ALLOWING ME TO SHARE SOME HIGHLIGHTS OF OVER A DECADE OF CAD EXPERIENCE. IN CONCLUDING I WOULD LIKE TO RELATE A HUMOROUS STORY ABOUT A SERIOUS STATIC PROBLEM A USER ENCOUNTERED. I AM LED TO BELIEVE THAT THIS IS A TRUE STORY BUT SINCE I DID NOT PERSONALLY ENCOUNTER IT I CANNOT VOUCH FOR ITS TRUTH.

IT SEEMS A USER HAD INSTALLED A NEW CAD SYSTEM THAT WAS FUNCTIONING PERFECTLY, EXCEPT WHEN ONE TRAINEE, A YOUNG LADY, TRIED TO USE THE SYSTEM.

THE INSTANT SHE TOUCHED THE SYSTEM, A STATIC DISCHARGE OCCURRED AND THE SYSTEM CRASHED. THE VENDOR TRIED EVERYTHING TO SOLVE THE PROBLEM; STATIC MATS WERE INSTALLED, MORE GROUND WIRE ADDED, ROOM HUMIDITY WAS INCREASED ALL TO NO AVAIL. AFTER MUCH INVESTIGATING, THE SOURCE OF THE PROBLEM WAS FINALLY REVEALED. IT SEEMS THIS YOUNG LADY HAD A LONGING FOR PURE SILK UNDERPANTS, AND THIS WAS THE SOURCE OF THE STATIC BUILDUP. SWITCHING UNDERPANTS OF ANOTHER MATERIAL SOLVED THE PROBLEM.

THE ONLY QUESTION THAT REMAINS UNANSWERED IS HOW DID THEY DISCOVER THAT THE YOUNG LADY WAS WEARING PURE SILK UNDERPANTS?

COMPUTER PROGRAM SPECIFICATIONS

AND

ASSOCIATED DOCUMENTATION

by

Raymond J. Schmitt

Kearfott Division

The Singer Company

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INTRODUCTION

A relatively few years ago, an employee charged with responsibility for the identification, documentation and release of computer program media at my company included in his description of a specific software package the term "concatenation" (slide 1). It was a new term to both of us. Since the word had been used by one of our more erudite doctoral scholars, my question of its use was not to its accuracy but rather, were we establishing a new line of jargon? Of course, the word has endured, its meaning clearly showing the closely linked elements of a computer program. The reason I recall it, is that it dates for me the time period when my company, as well as industry as a whole, began to address software as software, rather than in terms of hardware standards.

The evolution of software documentation, like all new standard practices, suffered from a variety of growing pains. In the early days, software engineering personnel demonstrated little knowledge of configuration management practices. Computer media on which data

was stored (usually card decks or tapes) were most often filed in a software engineer's desk drawer (slide 2). Each engineering group developed its own standards for desk-drawer identification and control. The only types of documentation conceived were Programmers Manuals, providing internal design data for members of the software engineering group, and Users Manuals for customer application of a given program. In the event an individual left his group or company, a large proportion of the engineering configuration knowledge for his project left with him. Only practical, immediate use factors were considered in determining the scope of documentation produced.

As applications began to include hardware test functions, and then overall system mission requirements, the "need to know" and to guarantee product performance and uniformity surpassed the fear of delving into the black-magic wizardry associated with computer programs. Along came our hardware-drafting-oriented configuration standards people (slide 3)... eager to subdue the software beast and chain it to the hardware practices that had served so well for so long. Heard the loudest were the advocates of software assembly drawings, software schematics, and software parts lists, all to be prepared in accordance with MIL-STD-100. The beast was recognized, but the feeble attempts to handle it were inadequate.

Much water has since gone over the dam. Hardware and software people have learned much of each others problems and the languages needed to communicate with each other. In fact, the necessity to

deal with firmware and the use of computers as engineering, drafting, and manufacturing tools has continued to increase the interchange and application of knowledge between these disciplines. We now find software engineering and quality assurance personnel so engrossed in configuration management and test practices that the pendulum has swung clearly into a new danger zone (slide 4). Ten years ago formal documentation of software contributed only between 5 and 10% to my company's engineering documentation page-count. Today, it accounts for 75 to 80%. I'm sure we represent the norm rather than the unusual for companies in similar high-technology product areas that design and produce programmable types of equipment. Ten years ago documentation was insufficient. The first challenge addressed for the '80's has been "tailoring" (slide 5) ... tailoring the extent and form of documentation to its mission requirements. The second challenge is the continued development of computer-aided resources to produce the detailed segments for computer program specifications and validation documentation.

MILITARY PRACTICES

Let's take a look at software Government practices over the years. The first major attempt at establishing documentation practices for computer programs were initiated with the Air Force's AFSCM 375-1 and the Navy's WS8506. Evolution has progressed to the Air Force's MIL-STD-483/490 and the Navy's MIL-STD-1679. Most recently, much effort has been expended on a proposed joint standard, designated DOD-STD-SDS during its development phase.

My company selected the MIL-STD-483/490 approach for its standard practice (slide 6). In 1970 when MIL-STD-483 was published by the U.S. Air Force, it included updates to MIL-STD-490, which had been prepared for DOD and released in 1969.

These updates were supposed to be temporary, in effect until MIL-STD-490 would be revised. Then, appropriate matter would be included in the MIL-STD-490 update and deleted from MIL-STD-483. In actuality, when a major revision was established for computer program documentation in 1979, it was more convenient to revise MIL-STD-483 to incorporate the latest practices since it was an Air Force document. MIL-STD-490 has yet to be officially revised in substance; however, substantial revisions have been proposed as Notice 3 by the SDS project team.

The approach of establishing baselines for phases of procurement in MIL-STD-490/483 has been consistent with practices used for hardware configuration items. When software Computer Program Configuration Items (CPCI's) are allocated as functional elements of systems or subsystems, a Development or Part I specification is prepared (slide 7) to specify design and development criteria. In software, this item basically provides the mathematical equations to be solved by the programmer, and the validation requirements to qualify the final product. This specification forms the Development Baseline for design and development, which is the controlling baseline at the Preliminary Design Review (PDR) conducted by the seller for buyer approval.

The Product or Part II Specification (slide 8) establishes the Product Baseline. This specification provides definition of the detailed as-coded computer program prepared by programmers. It also establishes the verification procedures applicable to the reproduction of the CPCI or any pertinent element of the CPCI. General program requirements are covered in paragraphs 3.1 through 3.9 of the MIL-STD-483 Product Specification. A preliminary Product Specification is baselined at a Critical Design Review at which time all design approaches to program functional elements are approved.

Paragraphs 3.10 and 3.11 of this document provide the actual detailed design descriptions, including such items as flow charts and listings for each component of the as-designed program. As such these sections can be compared to the set of drawings for hardware. They are completed for the Physical Configuration Audit (PCA) conducted prior to shipment of the CPCI product.

MIL-STD-1679 basically corresponds to this same MIL-STD-490/483 baseline management approach (slide 9). However, the Development Baseline specification is entitled Program Performance Specification, and the Product Baseline is established by two documents. The Program Design Specification establishes general design requirements which can be finalized at the Critical Design Review. The Program Description Document corresponds to the

detailed (coded) program and is finalized prior to first article delivery or at PCA. This system is geared to formalizing specific documents when specific procurement milestones are achieved.

Other practices have also been milestone sensitive. For example the Air Force Milestone Notation System in accordance with Exhibit 61-47B (slide 10). NASA practice (slide 11) also provides milestone sensitive design documentation as did the Navy's WS8506 (slide 12).

The latest proposed practice is provided in DOD-STD-SDS (slide 13). In addition to required documents for development and product baselines, optional documentation previously omitted in MIL-STD-490/483 has been added. In this approach, the product baseline is established in two required phases, in the manner provided by MIL-STD-1679. This enables preparation and baselining of documentation at logical milestones associated with the establishment of general requirements and, later, when the CPCI is fully coded. Additionally, the new standard and proposed revisions to Data Item Descriptions integrate the procurement of CPCI's into MIL-STD-483 and MIL-STD-490 configuration management practices. In fact, substantive updates to both of these standards are finally addressed by the SDS recommendations. Of greater importance, this standard evidences a good deal of input by software programming specialists. It provides for alternate tools for describing programs that enable the design to dictate documentation details, rather than document practice to limit design tools.

MY COMPANY'S STANDARD PRACTICES

As discussed earlier, my company's internal practices follow the MIL-STD-490/483 approach for specifications. A list of document types used for software is provided by slide 14. These documents are employed to the extent imposed by design disclosure project requirements (slide 14). In any event, note that when a computer program medium (for example, magnetic tape, paper tape, discs, etc.) is shipped, it must be released to a controlled central records department which is charged with the reproduction of the computer program medium and its corresponding documentation for shipment. Whether shipped or not, each computer program medium can only be released in a set that includes the medium, a Computer Program Media Document and a Version Description Document. The Computer program medium itself is assigned a part number and controlled as a hardware-type item. Changes to the program contained on the computer program medium require assignment of a new part number.

The Computer Program Media Document (slide 16) specifies the physical characteristics of the computer program media; provides a base for a significant dash-number, part-identification system; and specifies computer program media reproduction procedures.

The Version Description Document (VDD) (slide 17) describes the software resident on the computer program media and specifies the differences between the current program version and other program versions. Additionally, all known bugs and functions which have not been implemented in the current program version are delineated.

My company also creates the following documents:

- Users Manuals (slide 18)
- Validation Test Plans (slide 19)
- Validation Procedures (slide 20)
- Validation Data Packages (slide 21)
- Program Listing Documents

HARDWARE EMBEDDED SOFTWARE

Documentation discussed thus far has dealt with software CPCI's and the computer program media used for storage and delivery of these CPCI's. There are other related areas of software that require documentation at different levels. The first is microcode, the software normally implemented in semiconductor devices that provides operating characteristics to a functional end-item of hardware. A change to this software changes the capabilities of the items in which it is housed. It can be described as the basic brains of a programmable unit, rather than the information applied to the brains for a specific application. Whereas a software package is intended for processing by a computer, a microcode program is the processOR.

Devices used for microcode and other hardware-related applications are hardware-embedded. Software resident in these devices is properly termed "firmware." The hardware configuration design disclosure in such instances is incomplete without firmware

definition. Since these firmware items are intended for permanent storage, they are normally implemented by non-alterable semiconductor devices, that is by Read Only Memory Devices (ROM's) or Programmable Read Only Memory Devices (PROM's).

My company documents ROM's and PROM's using control drawing practices. We procure a ROM with a Specification Control Drawing (SCD) that references a Truth Table (slide 22) for each memory device tabulated on the SCD. For PROM's, which are programmed in-house, we procure the unprogrammed memory device with an SCD. Then, an Altered Item Drawing (AID) is prepared, which references the purchased item by SCD-based part number, and specifies programming in accordance with a Truth Table. These Truth Tables provide the actual binary configuration (that is the BIT content at each address within the memory device). The hardware design disclosure is thereby complete. For manufacturing purposes, the contents of the Truth Table are stored on a controlled computer program medium which is used in a Loader/Verifier unit that programs the memory device.

Separately, for internal control purposes, flow charts are prepared for microcode programs. These internal documents are referenced in a Version Description Document. They enable a Programmer to revise microcode software when required, either for a revised hardware baseline or for new applications.

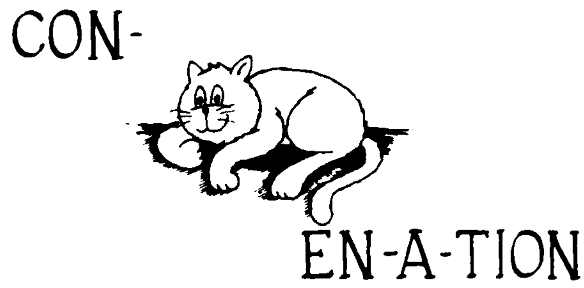
In today's hardware designs, semiconductor devices are also used to implement CPCI software. In this case, since software is subject to change, the firmware device is normally an EPROM, that is an eraseable PROM. For such applications, my company usually populates a Memory Circuit Card Assembly with the sum total of EPROM's required to implement the CPCI along with input/output and control circuitry. In this case, the entire program is loaded onto the circuit card via card connectors after part population. A support PROM Generator Program is used to organize the CPCI object code to enable loading by Loader/Verifier equipment. We now have the case of a fully documented software program, that also requires documentation as firmware when procurement of spare programmed circuit cards is required. To accomplish this, my company creates a higher-level assembly drawing (slide 23) and its associated parts list. In essence, this circuit card assembly documentation references a Truth Table (listing) that specifies the entire contents in EPROM that are loaded onto an unprogrammed circuit card, and marked to provide the CPCI version number associated with the contents in memory.

CHALLENGES FOR THE '80's

Let's take a look at the challenges on the horizon:

- First - Let's smooth out the wrinkles in DOD-STD-SDS and get it published. Let's go a step further and ensure that this single approach is used by all services. In accordance with the SDS project, let's update the entire series of configuration management and documentation preparation standards to purge MIL-STD-483 of requirements which properly belong in other DOD documents.
- Second - Let's update DOD-STD-100 to cover hardware documentation requirements for embedded software (firmware).
- Third - Let's get the programmers even more involved in documentation practices. Specifically let's learn from the techniques used in computer-aided engineering, drafting and manufacturing. Certainly support software could be written to derive much or all of the detailed design information from the as-coded program. Literally hundreds of pages are used to describe these details for a major CPCI.
- Fourth - What about developing automatic validation procedures, again assembled via support software programs. At my company, we released a 5,000 page Validation Plan last year for a major CPCI.

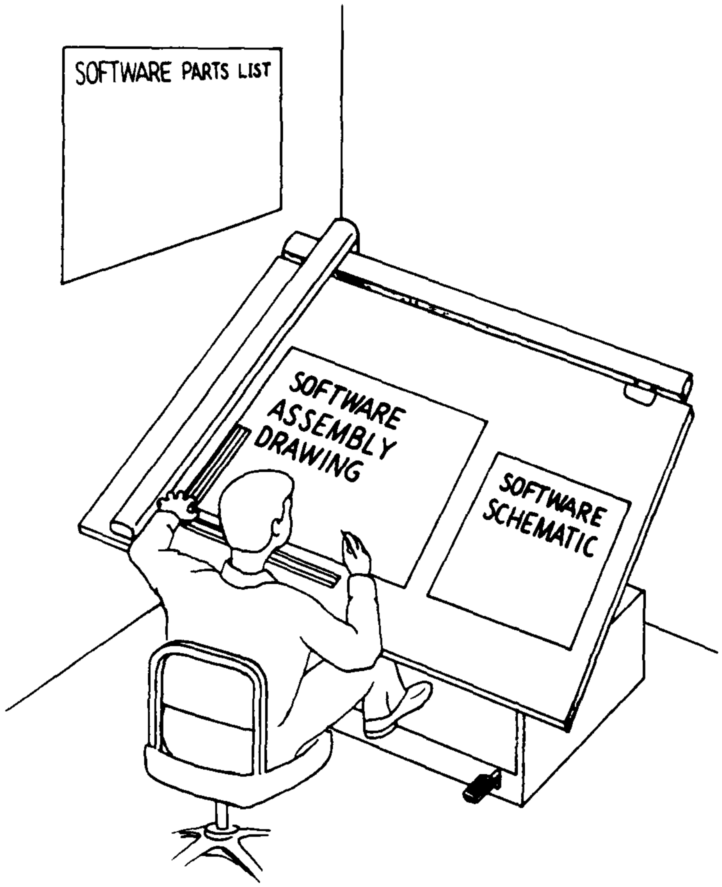
In summary, software documentation is directly related to automatic data processing (ADP); all avenues for use of ADP should be examined for the assembly of this documentation.



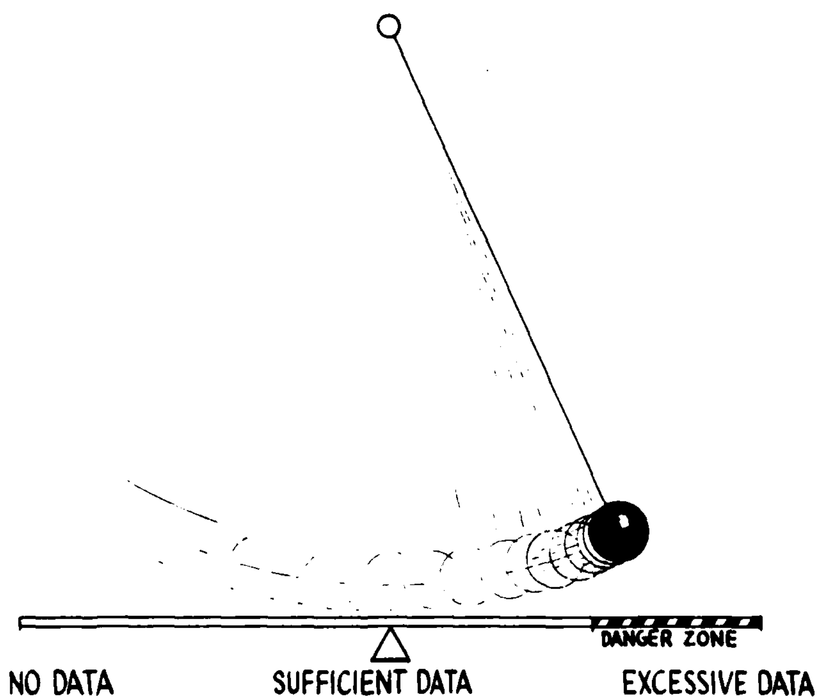
WHAT KIND OF CAT IS THIS?

(SLIDE 1)

(SLIDE 2)



(SLIDE 3)



(SLIDE 4)

THE TAILOR TABLE

OR

... ONLY THE BARE FACTS

(SLIDE 5)

SINGER KEARFOTT PRACTICE BASED ON MIL STANDARDS

SINGER-KEARFOTT	MIL-STD-490	MIL-STD-483
Computer Program Development Specification	Type B5 Computer Program Development Specification	Computer Program Configuration Item Specification (Part I)
Computer Program Product Specification	Type C5 Computer Program Product Specification	Computer Program Configuration Item Specification (PART II)

(SLIDE 6)

COMPUTER PROGRAM DEVELOPMENT SPECIFICATIONS

- Describes all requirements necessary to design the required computer program in terms of performance. It provides the logical detailed descriptions of the performance requirements of a digital computer program.
- Serves as the documentation necessary to enable the design, development and testing of a computer program.
- Prepared prior to the development of the computer program by personnel who have knowledge of the system and its operational concepts, but who do not necessarily have detailed knowledge of programming terminology.
- Reflects performance criteria in terms of operational, functional and mathematical language.
- Baseline document for subsequent software efforts.
- Part I Specification, Type B5.
- Format per MIL-STD-483/MIL-STD-490.

(SLIDE 7)

COMPUTER PROGRAM PRODUCT SPECIFICATIONS

- Specifies design description of the computer program based on the performance requirements.
- Prepared by personnel with an intimate knowledge of digital computer system architecture and programming, as well as a good understanding of the operational concepts in the overall system.
- Written in programming terminology; translates the Development Specification requirements into detailed technical, rather than functional, terms.
- Provides a complete technical description of all computer subprogram functions, structures, operating environments, constraints, data organization and control flows, for the subject computer program.
- Serves as the essential instrument for ongoing and subsequent uses, including diagnosing troubles, making adaption changes, designing and implementing minor or major modifications to the system, and facilitating rapid familiarity with the subprogram functions by new personnel.
- Part II Specification, Type C5.
- Format per MIL-STD-483/MIL-STD-490.

(SLIDE 8)

MIL-STD-483/490 VS MIL-STD-1679

<table>
<tr><th>MIL-STD-483/490</th><th>MIL-STD-1679</th></tr>
<tr><td>COMPUTER PROGRAM DEVELOPMENT SPECIFICATION (PART I)</td><td>PROGRAM PERFORMANCE SPECIFICATION</td></tr>
<tr><td rowspan="2">COMPUTER PROGRAM PRODUCT SPECIFICATION (PART II)</td><td>PROGRAM DESIGN SPECIFICATION (GENERAL REQUIREMENTS)</td></tr>
<tr><td>PROGRAM DESCRIPTION DOCUMENT (AS-CODED PROGRAM DETAILS)</td></tr>
</table>

(SLIDE 9)

SINGER-KEARFOTT PRACTICE VS MILESTONE NOTATION IN ACCORDANCE WITH SSD EXHIBIT 61-47B

<table>
<tr><th>SINGER-KEARFOTT</th><th>MILESTONE NOTATION</th></tr>
<tr><td rowspan="2">Computer Program Development Specification</td><td>Milestone 1: Requirements</td></tr>
<tr><td>Milestone 2: Implementation Concepts</td></tr>
<tr><td rowspan="2">Computer Program Product Specification</td><td>Milestone 3: Interface Definitions</td></tr>
<tr><td>Milestone 4: Program Design</td></tr>
</table>

<table>
<tr><td>Computer Program Validation Plan</td><td rowspan="2">Milestone 6: Integration Test Procedure</td></tr>
<tr><td>Computer Program Validation Procedure</td></tr>
</table>

(SLIDE 10)

SINGER-KEARFOTT PRACTICE VS NASA SPACE SHUTTLE STANDARD IN ACCORDANCE WITH JSC 07700, VOLUME XVIII, BOOK 3

SINGER-KEARFOTT	NASA
Computer Program Development Specification	Software Requirements Specification
	Preliminary Software Design Specification
Computer Program Product Specification	Detailed Software Design Specification (Code To)
	Detailed Software Design Specification (As-Built)
Computer Program Validation Plan	Software Test Requirements Software Test Plan
Computer Program Validation Data Package	Software Verification Test Report

(SLIDE 11)

SINGER-KEARFOTT PRACTICE VS WS8506

SINGER-KEARFOTT	WS8506
Computer Program Development Specification	Computer Program Performance Specification (CPPS)
Computer Program Product Specification	Computer Program Design Specification (CPDS)
	Data Base Design Document
	Computer Subprogram Design Documents (CSDD)
Computer Program Validation Plan	Computer Program Test Plan
Computer Program Validation Procedures	Computer Program Test Procedures
Computer Program User's Manual	Computer, Program Operators Manual

(SLIDE 12)

CURRENT MIL-STD-490/483 VS DOD-STD-SDS 1/

MIL-STD-490/483	DOD-STD-SDS 490 REVISIONS
TYPE B5 COMPUTER PROGRAM DEVELOPMENT SPECIFICATION (CPDS)	TYPE B5 CPDS o TYPE B5a - SOFTWARE REQUIREMENTS SPECIFICATION o TYPE B5b - INTERFACE REQUIREMENTS 2/ SPECIFICATION
TYPE C5 COMPUTER PROGRAM PRODUCT SPECIFICATION (CPPS)	TYPE C5 CPPS o TYPE C5a - SOFTWARE TOP LEVEL DESIGN DOCUMENT o TYPE C5b - SOFTWARE DETAILED DESIGN DOCUMENT o TYPE C5c - DATA BASE 2/ DESIGN DOCUMENT o TYPE C5d - INTERFACE DESIGN 2/ DOCUMENT

NOTE 1 - DOD-STD-SDS PRACTICES ARE ACHIEVED THROUGH CHANGES TO MIL-STD-490/483 AND OTHER EXISTING DATA ITEMS

2 - OPTIONAL DOCUMENTATION

(SLIDE 13)

DOCUMENT TYPES

1. COMPUTER PROGRAM MEDIA DOCUMENT
2. COMPUTER PROGRAM VERSION DESCRIPTION DOCUMENT (VDD)
3. COMPUTER PROGRAM USERS MANUAL
4. COMPUTER PROGRAM DEVELOPMENT SPECIFICATION
5. COMPUTER PROGRAM PRODUCT SPECIFICATION
6. COMPUTER PROGRAM VALIDATION PLAN
7. COMPUTER PROGRAM VALIDATION PROCEDURES
8. COMPUTER PROGRAM VALIDATION DATA PACKAGE
9. COMPUTER PROGRAM LISTING DOCUMENT

STANDARD LEVELS OF DOCUMENTATION

A. FULL DISCLOSURE

B. EXPANDED DISCLOSURE

C. NORMAL (USER LEVEL) DISCLOSURE

(SLIDE 14)

PROGRAM/DOCUMENTATION DELIVERY REQUIREMENTS FOR EACH DISCLOSURE LEVEL

ITEM	FULL DISCLOSURE	EXPANDED DISCLOSURE	NORMAL (USER LEVEL) DISCLOSURE
USER'S MANUAL	YES	YES	YES
VERSION DESCRIPTION DOCUMENT (2)	YES	YES	YES
MEDIA DOCUMENT (2)	YES (1)	YES (1)	YES (1)
OBJECT TAPE - ABSOLUTE/RELOCATABLE	YES	YES	YES
SOURCE TAPE	YES	NO	NO
SOURCE LISTING DOCUMENT	YES	OPTIONAL	NO
DEVELOPMENT SPECIFICATION	YES	YES	NO
PRODUCT SPECIFICATION	YES	NO	NO
VALIDATION PLAN	YES	OPTIONAL	NO
VALIDATION PROCEDURES	YES	NO	NO
VALIDATION DATA PACKAGE	OPTIONAL	NO	NO

NOTES:

(1) ALWAYS DEVELOPED FOR IDENTIFICATION AND CONTROL - USUALLY NOT DELIVERED

(2) MEDIA DOCUMENT AND VERSION DESCRIPTION DOCUMENT MUST BE PREPARED PRIOR TO RELEASE OF PROGRAM TO FILE.

(SLIDE 15)

COMPUTER PROGRAM MEDIA DOCUMENT

- Provides for identification and configuration control for a media (i.e., paper tape, magnetic tape, discs, cassettes, etc.)
- Specifies the Part Number for the media.
- Specifies physical description of the media.
- Lists all versions of the media.
- Specifies general content of each file.
- Describes the identification label on the media.
- Specifies procedure for reproducing the media and the method of verifying reproduced copy.

(SLIDE 16)

VERSION DESCRIPTION DOCUMENT

- Provides functional outline of the computer program capability.
- Specifies differences between current version and other versions similar in content.
- Lists all known bugs and functions which have not yet been implemented.
- Gives recommendations for proper operation of the system in the presence of these bugs or anomalies.
- Repository for information relating to the installation of the program at the users facility.
- A convenient repository for miscellaneous user information.
- A separate VDD is required for each released program version.

(SLIDE 17)

COMPUTER PROGRAM USERS MANUAL

- Presents procedures for executing the computer program and interpreting its outputs.

- In hands-off environment, (e.g., a batch run in a large computer center) the document describes:

  a. the logic functions of the program.

  b. the techniques for providing input to the program.

  c. any information required to interpret the output.

- In hand-on environment, (e.g., the control program in a realtime data collection and reduction system) document describes the operating instructions, in addition to the items specified in hand-off environment.

- Provides monitoring procedure of the computer program while in operation.

- Provides trouble and malfunction indications.

- Specifies procedures to restart the system operation after an abort or interruption in the operation of the computer program.

(SLIDE 18)

COMPUTER PROGRAM VALIDATION (TEST) PLAN

- Contents governed by the testing requirements and criteria specified in the CPCI Development Specification.
- Specifies method and content for each program test activity.
- Identifies level of testing and the specific functions or subprograms that are involved in the test, including:
  - a. Subprogram testing
  - b. Integration testing
  - c. Acceptance testing
  - d. System testing
- Provides objectives for each test.
- Summarizes test methods and type of system environment to be used.
- Specifies hardware requirements necessary for conducting the test, i.e., computer complex with its peripheral equipment and other supporting equipment that interfaces with the computer complex.
- Gives supporting software requirements.
- Specifies precise functions to be tested.
- Provides quality assurance requirements.

(SLIDE 19)

COMPUTER PROGRAM VALIDATION PROCEDURES

- Developed from the Validation Plan.
- Presents detailed instructions for setup, operation and evaluation of results for each level of testing.
- Procedures are intended for use by personnel responsible for the verification of program content and operation, from initiation to completion of program development.
- Describes the total equipment, manpower, computer programs and supporting documentation required for operation.
- Specifies detailed procedure covering all aspects of operation.
- Provides criteria for satisfactory/unsatisfactory operation.

(SLIDE 20)

COMPUTER PROGRAM VALIDATION DATA PACKAGE

- Depository for data generated during the testing of the computer program to substantiate successful execution of the validation tests.
- Each version of the computer program is required to be validated and therefore is required to have a Validation Data Package.

COMPUTER PROGRAM LISTING DOCUMENT

- Consists of a source listing of the computer program.
- Source language to be the language in which the program is developed and maintained.

(SLIDE 21)

MICROCIRCUIT - TRUTH TABLE | THE SINGER COMPANY, KEARFOTT DIVISION, LITTLE FALLS, N.J. | FSCM NO 88818 | DRAWING NO A398A | REV

SIZE A | SCALE NONE

DATE 83/12/12

CONTRACT NO NO-CONTRACT-YET | DATA RIGHTS REVIEW 05223(NP) | SHEET 1

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0064	HHHHHLLL	HHHHHHHH	HHHHHHLH	HHHHHHHH	HHHHHLHL	HHHHHHHH	HHHHHHLH	HHHHHHHH
0072	HHHHHHLL	HHHHHHHH	HHHHHHLH	HHHHHHHH	HHHHHLHL	HHHHHHHH	HHHHHHLH	HHHHHHHH
0080	HHHHLLLL	HHHHHHHH	HHHHHHLH	HHHHHHHH	HHHHHLHL	HHHHHHHH	HHHHHHLH	HHHHHHHH
0088	HHHHHHLL	HHHHHHHH	HHHHHHLH	HHHHHHHH	HHHHHLHL	HHHHHHHH	HHHHHHLH	HHHHHHHH
0096	HHHHHLHH	HHHHHHHH	HHHHHHLH	HHHHHHHH	HHHHHLHL	HHHHHHHH	HHHHHHLH	HHHHHHHH
0104	HHHHHHLL	HHHHHHHH	HHHHHHLH	HHHHHHHH	HHHHHLHL	HHHHHHHH	HHHHHHLH	HHHHHHHH
0112	HHHHLLLL	HHHHHHHH	HHHHHHLH	HHHHHHHH	HHHHHLHL	HHHHHHHH	HHHHHHLH	HHHHHHHH
0120	HHHHHHLL	HHHHHHHH	HHHHHHLH	HHHHHHHH	HHHHHLHL	HHHHHHHH	HHHHHHLH	HHHHHHHH
0128	HHHHHHLH	HHHHLLHL	HHHHLLHH	HHHHLLHL	HHHHLLLH	HHHHLLHL	HHHHLLHH	HHHHLLHL
0136	HHHHLHLL	HHHHLLHL	HHHHLLHH	HHHHLLHL	HHHHLLLH	HHHHLLHL	HHHHLLHH	HHHHLLHL
0144	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH
0152	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH
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0168	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH
0176	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH
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0216	HHHLLLLL	HHHLLLLH	HHHLLLHL	HHHLLLHH	HHHLLHLL	HHHLLHLH	HHHLLHHL	HHHLLHHH
0224	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH
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0240	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH
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0280	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH
0288	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH
0296	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH
0304	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH
0312	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH
0320	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH
0328	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH
0336	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH
0344	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH	HHHHHHLH

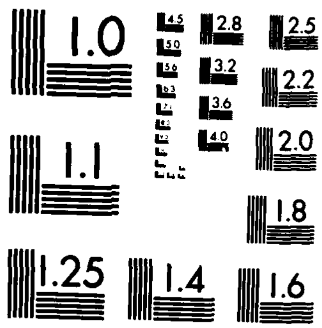
TRUTH TABLE DOCUMENT

(SLIDE 22)

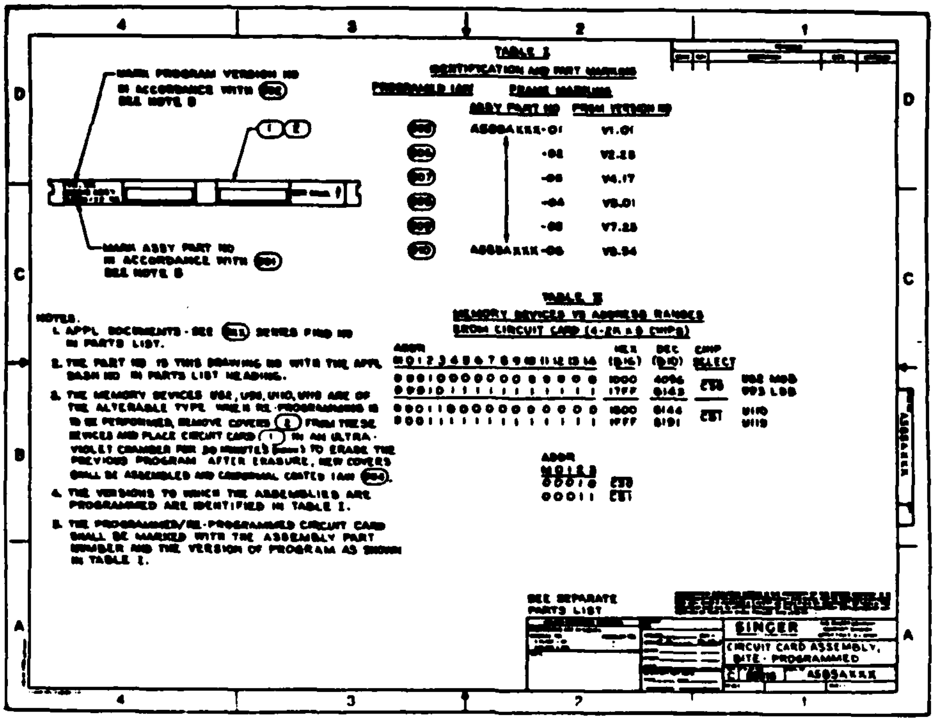
AD-A152 549 PROCEEDINGS OF THE ANNUAL MEETING (26TH) TECHNICAL DOCUMENTATION DIVISION..(U) AMERICAN DEFENSE PREPAREDNESS ASSOCIATION ARLINGTON VA 10 MAY 84

2/4

UNCLASSIFIED F/G 5/2 NL



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A



ASSEMBLY DRAWING

PARTS LIST　THE SINGER COMPANY　FSCM NO 00010　PLA59AXXX　REV -
KEARFOTT DIVISION
LITTLE FALLS, N.J.　DATE 01/11/18

CONTRACT NONE　DATA RIGHTS REVIEW 01602(NP)　CKT CD ASSY, PRGM　SHEET 1

ASSY DASH NO -01,02,03,04,05,06

D P	APPL - NO	FIND NO. REF DES	QTY REQ	U/M	U C	PART OR ITEM ID NO	NOMENCLATURE	FSCM NO	DRAWING OR DOC NUMBER	PL REV COD.	LTR
P	01-03	1	1			A539AXXX-01	CKT CD-UNPRGM	00010	A539AXXX		
P	04-06	1	1			A539AXXX-02	CKT CD-UNPRGM	00010	A539AXXX		
R		2	4			A315A712-103	COVER	00010	A315A712		
B		901		R		Y061A001-5713	SPEC,MARKING	00010	Y061A001		
B		902		R		Y061A001-0713	SPEC,MARKING	00010	Y061A001		
		903		R		Y201A123E100	SPEC,ACPT TEST	00010	Y201A123E100		
B		904		R		C190010122	APPL OF INSUL CMPD.	00010	C190010122		
	01	905		R		A390AXXXT0101	TRUTH TABLE-V1.01	00010	A390AXXXT0101		
	02	905		R		A390AXXXT0102	TRUTH TABLE-V2.23	00010	A390AXXXT0102		
	03	905		R		A390AXXXT0103	TRUTH TABLE-V4.17	00010	A390AXXXT0103		
	04	905		R		A390AXXXT0104	TRUTH TABLE-V5.01	00010	A390AXXXT0104		
	05	905		R		A390AXXXT0105	TRUTH TABLE-V7.25	00010	A390AXXXT0105		
	06	905		R		A390AXXXT0106	TRUTH TABLE-V8.54	00010	A390AXXXT0106		

ABBR,SYM,AND COL USAGE (SEE ALSO MIL-STD-12)
APPL- BLANK = ALL DASH NO , DASH = THRU
FIND NO * OR REF DES 8 OR 9 = ITEM HAS NO FIND NO/REF DES
U/M (UNIT OF MEASURE)- R = REF DOC
UC (USAGE CODE)- FOR ITEM OF SAME FIND NO/REF DES- S = SELECT , P = PREFERRED ALTN , A = ALTN , I = SUPSD/REPL BY

DRAWING OR DOC NUMBER- * OR @ = VENDOR ITEM - SEE SPEC (*) OR SOURCE (@) CONTROL DRAWING
PL REV CODE- A = ADDED ITEM , F = FIND NO/REF DES CHANGE , I = REVISED ENTRY , Q = QTY REQD CHANGE , S/R = SUPSD/REPL BY ITEM OF SAME FIND NO/REF DES
PL REV LTR- REV AT WHICH CHANGE OCCURRED
DP- DATA PROCESSING CODE

SHEET 1 OF 1

(SLIDE 23)

PARTS LIST

SESSION 2

Workshop Coordinator

MR. T. L. GOLMIS
Hughes Aircraft Company

See sections S, T, and U for Session 2 workshop summaries.

SESSION 3

Chairman:	MR. BURTON G. SCHAEFER Pitney Bowes
Secretary:	MR. RICHARD E. KNOB Sperry Corporation Sperry Gyroscope Division

ELECTRONIC DOCUMENTATION INTERFACING

by

D. BURTON NEWLIN, JR.

General Engineer and Senior Staff Specialist

Defense Materiel Specifications
and Standards Office

Office of the Under Secretary of Defense
(Research and Engineering)

Mr. Newlin's remarks are included in his
Session I paper. See Section B.

ON-LINE CONFIGURATION MANAGEMENT AND ENGINEERING DATA

Charles J. Borum
Configuration Management Officer
PERSHING Project Manager's Office
U. S. Army Missile Command
Redstone Arsenal, Alabama 35898

American Defense Preparedness Association
Technical Documentation Division
May 8-11, 1984
El Tropicano Hotel, San Antonio, Texas

ON-LINE CONFIGURATION MANAGEMENT
AND ENGINEERING DATA

Charles J. Borum
Configuration Management Officer
PERSHING Project Manager's Office
U. S. Army Missile Command
Redstone Arsenal, Alabama 35898

Since 1970, Martin Marietta Orlando Aerospace and the U. S. Army Pershing Project Configuration Management Office have been working on several computerized systems to be used by technical personnel for creating engineering designs, engineering parts lists, and identifying engineering configurations. Increased productivity, improved accuracy, faster response time, and ease of access were primary objectives in the design of these systems. The ultimate aim is to deliver all data in digital format, thereby eliminating the need for hard copy distribution of drawings, microfilm, or other engineering and configuration management data. The major systems utilized are briefly described below:

- o DOCUMENTATION INFORMATION AND CONTROL SYSTEM (DIACS) is an on-line Information Management System (IMS)* data base that contains a complete catalog of in-house-designed parts plus vendor parts, materials, processes, and specifications required by the designer to develop Bills of Material for designs. DIACS maintains a complete definition of the design configuration, as proposed. It also tracks and updates the configuration as the design progresses, is completed, and is released. DIACS assigns document and part numbers, advance change numbers, and document revision letters and maintains status on these elements throughout the life of the document. The system provides the designer with a technique for calculating the cost and weight of assemblies and summing them to the end item level. Other outputs available to aid the designer as well as management are: Generation Breakdowns, Consolidated Bills of Material, Where-Used Data (from next assembly to end item), Approved Parts, Material and Process Listings (by project), and a wealth of statistical data used to monitor engineering activity and aid in proposal planning or pricing. DIACS provides automated transfer of data to the Manufacturing Bill of Material System, the Manufacturing Process Plan System, the Inventory and Order Management Systems, and several computer graphic systems. There are over 400 cathode ray tube (CRT) terminals and 60 printers available to access the system. The host central processing unit (CPU) for DIACS is an IBM 3033.

- o COMPUTER AUGMENTED DESIGN AND MANUFACTURING (CADAM)** is used primarily for two dimensional mechanical drawings. It also has the capability of producing machine control (N/C) tapes or discs from the engineering design for use in the Manufacturing tooling process.

- o SCI-CARDS+ is used to design printed wiring boards. It is a very powerful program that requires the engineer to define only the types of components, connect points, and board sizes. The system places the components and does all the circuit routing. By direct output or post-processing, the system produces the circuit artwork, assembly drawing, drill drawing, and marking drawing. To aid manufacturing, the post-processor also produces N/C tapes or disks for automatic drilling and routing of the board and for the insertion of component parts.

*IMS is a registered trademark of the International Business Machine Company
**CADAM is a registered trademark of the Lockheed-California Company
+SCI-CARDS is a registered trademark of Scientific Calculations, Inc., Rochester, New York

- o COMPUTERVISION (CV)* is used to prepare three dimensional drawings for use in handbooks and where a trimetric engineering drawing is needed for clarity. In addition, schematic diagrams are prepared using this system and graphics are transferred from the SCI-CARDS system for formatting on the final drawing.

- o COMPUTERIZED TEXT PROCESSING SYSTEMS are used in the preparation of A-size text drawings such as Test Requirement Documents, Systems Specifications, etc.

- o CHANGE HANDLING AND STATUSING INFORMATION SYSTEM (CHASIS) was designed to aid the Contracts Division in the preparation of formal changes requiring government approval and contract modifications. It is an IMS data base system that provides all the standardized documents required to complete an Engineering Change Proposal (ECP) in an on-line environment. As soon as the ECP is loaded on the data base, it is available throughout the division for impact and to the government for review. This system provides all of the text and forms required to submit an ECP. Approval of the ECP is by a password controlled system accessible by terminals in the project manager's office.

An interfacing data delivery system was developed that extracts data from these various data bases and combines it into a neutral data base and makes it available to the user on demand. The original objectives of this integrated system were:

(1) Develop an interface program that allows data from the several engineering and configuration management software systems used at Martin Marietta Orlando Aerospace to flow into a common format.

(2) Develop a program that permits the user to select documents in the engineering data base for transmission to his terminal.

(3) Provide the user with direct viewing of engineering drawings and changes, thereby supplementing the capability to examine engineering configuration and status data contained in DIACS.

(4) Develop an interface program to convert in-house data into a format that is acceptable to the government for submittal as Technical Data Packages (TDPs).

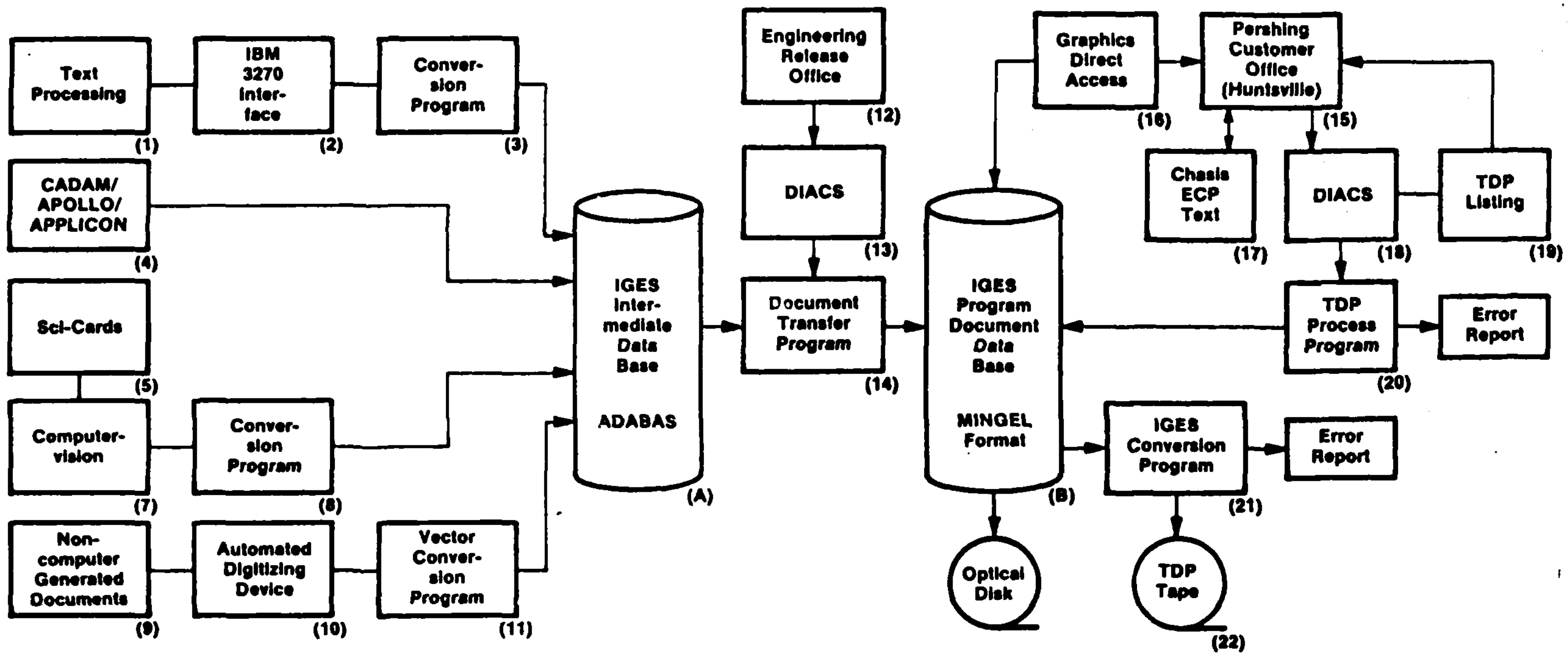
(5) Develop techniques which integrate manually prepared drawings and test data into the system.

The system has been operational since early 1982 and is called the Martin Marietta Aerospace Integrated Data Systems (MMAIDS).

Before selecting a common data base format for MMAIDS, we measured the volume of data the system would handle and studied several possible common formats. A CADAM formatted data base was selected for in-house and direct government access. Several factors influenced this decision: 1) CADAM is by far the major computer graphics system used in-house; 2) SCI-CARDS does not produce a completely formatted finished drawing; and 3) there was a readily available hardware/software package (SOFTCOPY)* for direct access to the CADAM type data base. To enhance the flexibility of MMAIDS, an Initial

*COMPUTERVISION CORPORATION is located in Bedford, Massachusetts
**SOFTCOPY is an IBM product.

Pershing documentation system flow



MINGEL = Martin Integrated Neutral Graphics Engineering Language

FIGURE 1

Graphics Exchange Specification (IGES) format for the delivery of TDP documentation was also selected.

As shown in Figure 1, all Pershing project documents prepared using Text Processing (1) equipment are transferred via an IBM 3270 interface (2) to the IBM 3033 and run through a CADAM conversion program (3) with the resulting output stored on an intermediate data base (A). Drawings prepared on CADAM, Appollo or Applicon (4) are copied directly on the intermediate data base (A). The artwork created by the SCI-CARDS system (5) is transferred to COMPUTERVISION (7). Using the COMPUTERVISION system, designers place the artwork on a format and add other notations required to complete the drawing. Drawings generated on COMPUTERVISION (7) are converted to CADAM format (8) and stored on the intermediate data base (A). All data stored on the intermediate data base is statused as "read only". Non-computer-generated documents (9), comprised primarily of data submitted by sub-contractors, will be automatically digitized (10), processed through a CADAM conversion program (11), and stored on the intermediate data base (A). Presently, this segment of the system is an open item. We have not been able to locate automated scanning equipment that digitizes data with the accuracy we believe is required. However, the "Audre" system was reviewed last month and appears to be adequate.

As the completed engineering drawing are approved and processed through the normal release system (12), DIACS (13), which is updated from a reserved to released status, will cause an IMS subroutine to create a Time Sharing Option (TSO) data set for execution of the Document Transfer Program (14) that moves the digitized information from the Intermediate Data Base (A) to the Program Document Data Base (B). If the document cannot be found at the proper revision level, an error report is generated.

From the moment the first document is transferred to the Program Document Data Base (B), the Pershing Configuration Management Office (15) has on-line access to view or print a reduced electrostatic copy using the SOFTCOPY package (16).

The SOFTCOPY capability is a critical element in speeding up approval of ECPs. With CHASIS (17), we have had our ECP text data on-line in the IMS environment to permit full interchange of data between the government and contractor. With SOFTCOPY (16), the Configuration Management Office can receive changes of any engineering drawing that is part of the ECP. By interleaving the graphics and text, the configuration manager has everything he needs to approve or reject an ECP. If, on the other hand, more data are required before making this decision, the system will provide it upon request. CHASIS has a built-in subroutine to approve ECP's under complete control of the Configuration Management Office. When the government (15) needs an entire TDP, the capability exists to access DIACS (13) to request a printout (19) of the documents which define the baseline of the end item or to request the listing as well as an IGES formatted tape. If a tape is requested, DIACS transfers the identification of the documents comprising the TDP (20) to a TSO data set which executes a program for accessing the Program Document CADAM formatted data base (B). The program selects the documents, processes them through a CADAM-to-IGES Conversion Program (21), and builds a TDP Tape (22) for delivery.

The concept of a computerized system for the delivery of technical design and configuration management data has been presented. This sytem gives easy, real time, paperless access to the specific data required by the user and accomplishes the following:

(1) Real time access to the data base always provides current data.

(2) The user can examine the available data and order what is specifically needed.

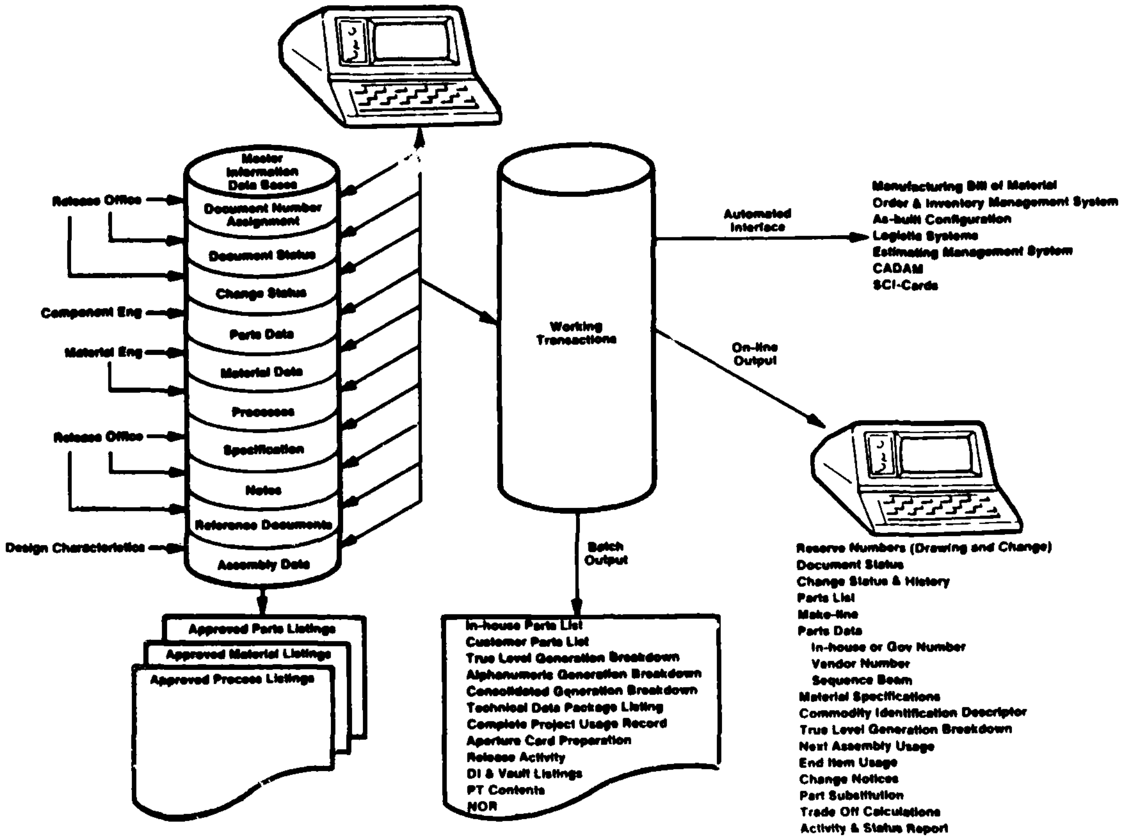
(3) The time to process a change for approval and distribute approved changes is markedly reduced.

(4) Delivery of a partial or complete TDP can now be accomplished faster and with greater accuracy.

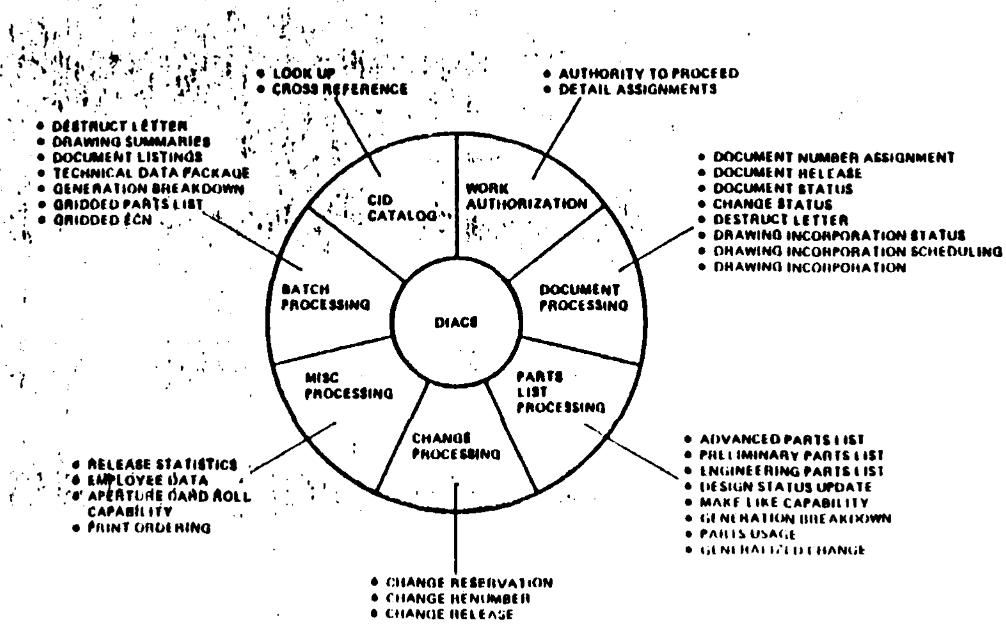
BIOGRAPHY

CHARLES J. BORUM is the Configuration Management Officer for the Pershing Weapon System at the Army Missile Command, Redstone Arsenal, Alabama. He has been responsible for Pershing Configuration Management since 1963. In the Configuration Management field, he has participated in various working groups to establish configuration management policies in the Army and the Department of Defense (DoD). These policies include establishment of engineering change proposal procedures for the Army and the DoD Adoption of Configuration Management. He was a member of the initial working group that established Army policy on configuration management. He has authored an article entitled "Found: A Practical Configuration Management System," published in the Defense Industry Bulletin of May 1966, and co-author of "Martin Marietta Aerospace Integrated Data System (MMAIDS)" presented to the "Automation Technology Institute Symposium", 8 September 1981.

DOCUMENTATION INFORMATION AND CONTROL SYSTEM (DIACS)



Engineering systems/engineering business



DOCUMENTATION INFORMATION AND CONTROL SYSTEM (DIACS)

RFP/Proposals	Contract Start Up	Design Effort	Engineering Release	Customer Requirement	Interfaces	Statistics
Define baseline	• Approved parts, materials, processes	• Parts list	• Document and part number assignment	• Customer parts list	SCI-cards	Release activity
• Advanced parts		• In house part no.			CADAM	
	• Long lead items	• Vendor part no.	• Document status	Tech data pkg		
• Make like		• Material spec no.			Midas (CID)	
		• Material code no.	• Change status and history	• Indentured parts list		
Consolidated B/M		• Process no.			• COSMOS	
		• Standard notes				
EMS (MIDAS)		• CID	• Change incorporation control	Engineering record	CTS	
		• Make like			Ramp	
			• Vault			
		• Where used data				
			• Aperture card generation			
		• Auto changes				
		• Calculations	• Print ordering			
				• On-line		

INTERFACES

SCI CARDS/CV (PWB DESIGN)
- PART DATA/REFERENCE DESIGNATORS

CADAM/CV (MECH DESIGN)
- PARTS LIST
- NOR
- SOFTCOPY

COSMOS (MFT REQT)
- BILL OF MATERIALS
- SPECIAL ORDER ITEMS

MIDAS (MATERIEL)
- EMS
- CID
- PRICING DATA

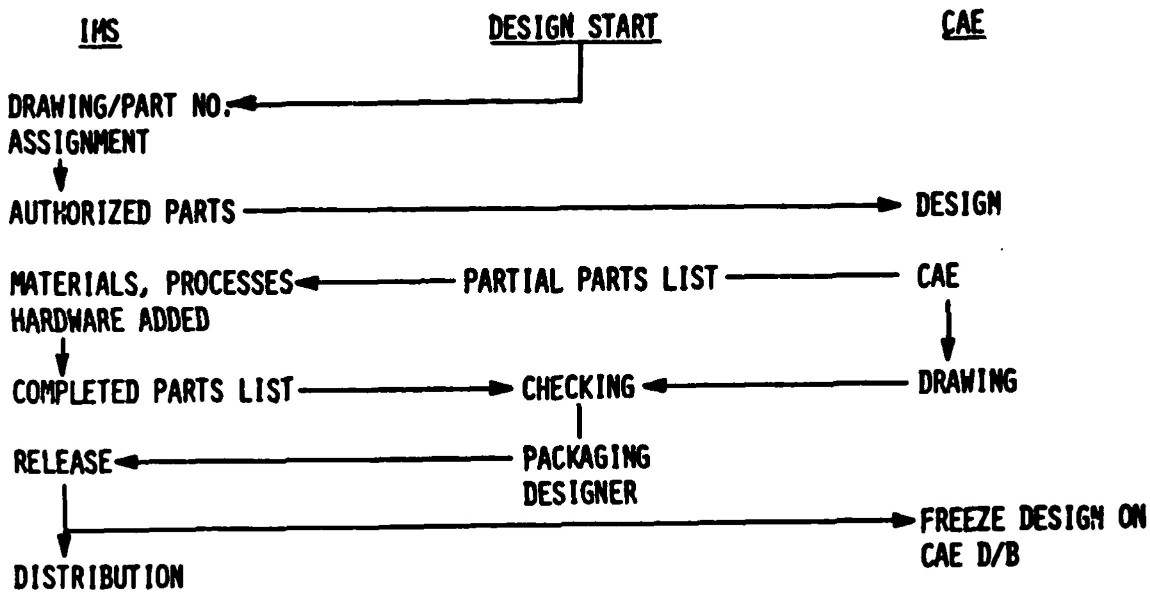
RAMP (MPP)
- DWG/CHG STATUS

CTS
- AS DESIGNED VS AS BUILT

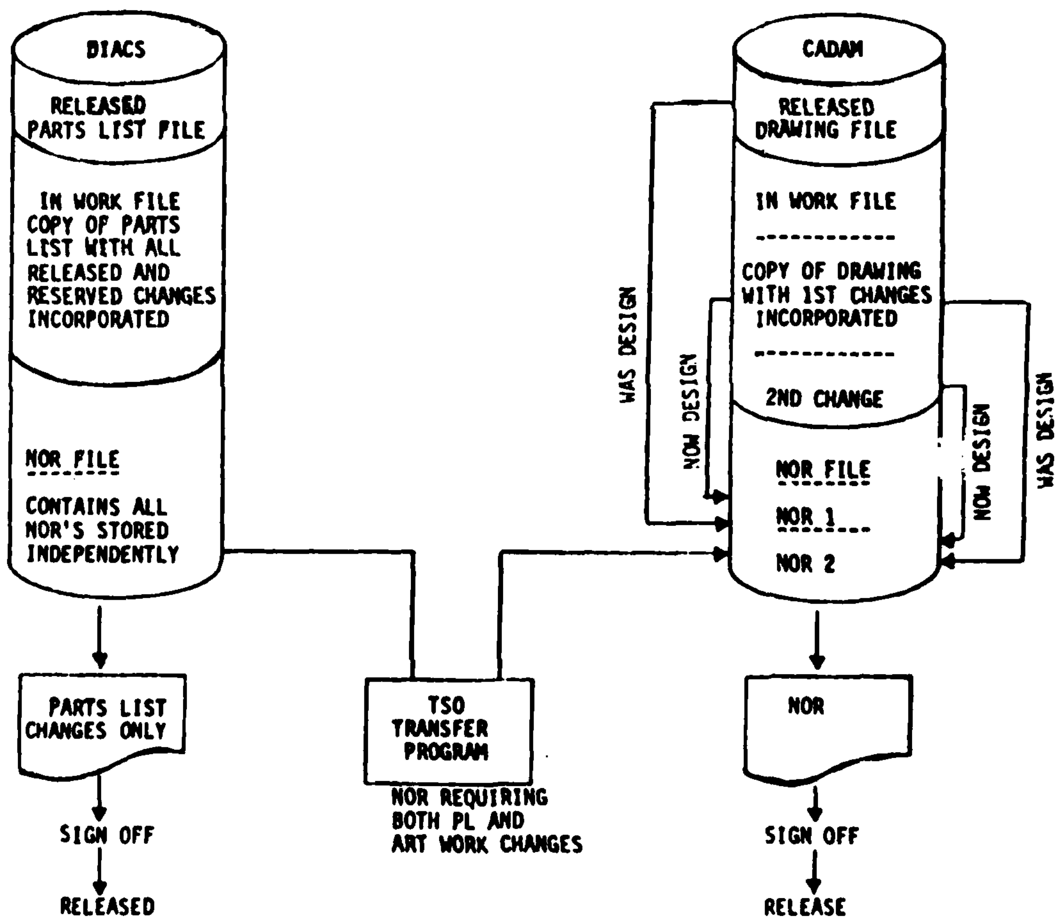
CUSTOMER REQUIREMENTS

MIL-SPEC PARTS LIST
TECH DATA PACKAGES
GENERATION BREAKDOWNS
ENGINEERING RECORD
APPROVED PARTS REPORT
APPROVED MATERIALS & PROCESSES

DIACS CAE INTERFACE



AUTOMATED NOR PREPARATION



USING THE XEROX STAR

Charles D. Fisher
RCA Government Communications Systems
Camden, New Jersey

INTRODUCTION: RCA, like most other companies, is seeking ways in which to increase engineering office productivity. Word processors are widely used, with their use increasing every day. One of the devices being evaluated within RCA is the XEROX "STAR" or 8010 workstation. This paper is based on our experience with STAR in a data/configuration/publications management environment. We prepared this paper -- including all graphics -- on a STAR workstation.

WHY THE XEROX STAR???

Before STAR was announced, we had acquired a number of Xerox 860 workstations for our engineering document composition system. This system consists of standalone workstations linked to a central file and printing facility, permitting resources to be shared while at the same time allowing independent standalone operation.

STAR offered us added capabilities -- including graphics and special equations -- compatible with what we already had. We wanted to add to, rather than alter, what we had so that the skills already acquired by our professional, technical, and clerical staff would not be lost. We needed only to supplement their existing skills.

Our purpose today is to briefly describe our experience, hoping that you'll find it of interest. The STAR is not the answer to everyone's needs, and this paper should not be regarded as an endorsement of any product by RCA, ADPA, or myself.

WHAT DO WE HAVE???

The system environment in which we use the STAR is shown in Figure 1. In addition to STAR, 860 workstations are used for input -- for straight text and tabular word processing we'll use the 860 in preference to STAR.

We have two laser printers. The Xerox 5700 laser printer is used where we need higher-speed reproduction; it isn't always possible to use the 5700 -- it doesn't have the font range or graphics handling power of the Xerox 8044 (the slower-speed laser printer). The 5700 accepts diskettes from the 860 workstations, from the OCR scanner, or from IBM workstations. We also have impact printers, most with paper feeders. At our central location we also have a wide-carriage printer, for copy up to about 25 inches wide.

The file server provides storage for data and support (training, help) software.

We also have an off-line OCR reader, producing diskettes for the 860.

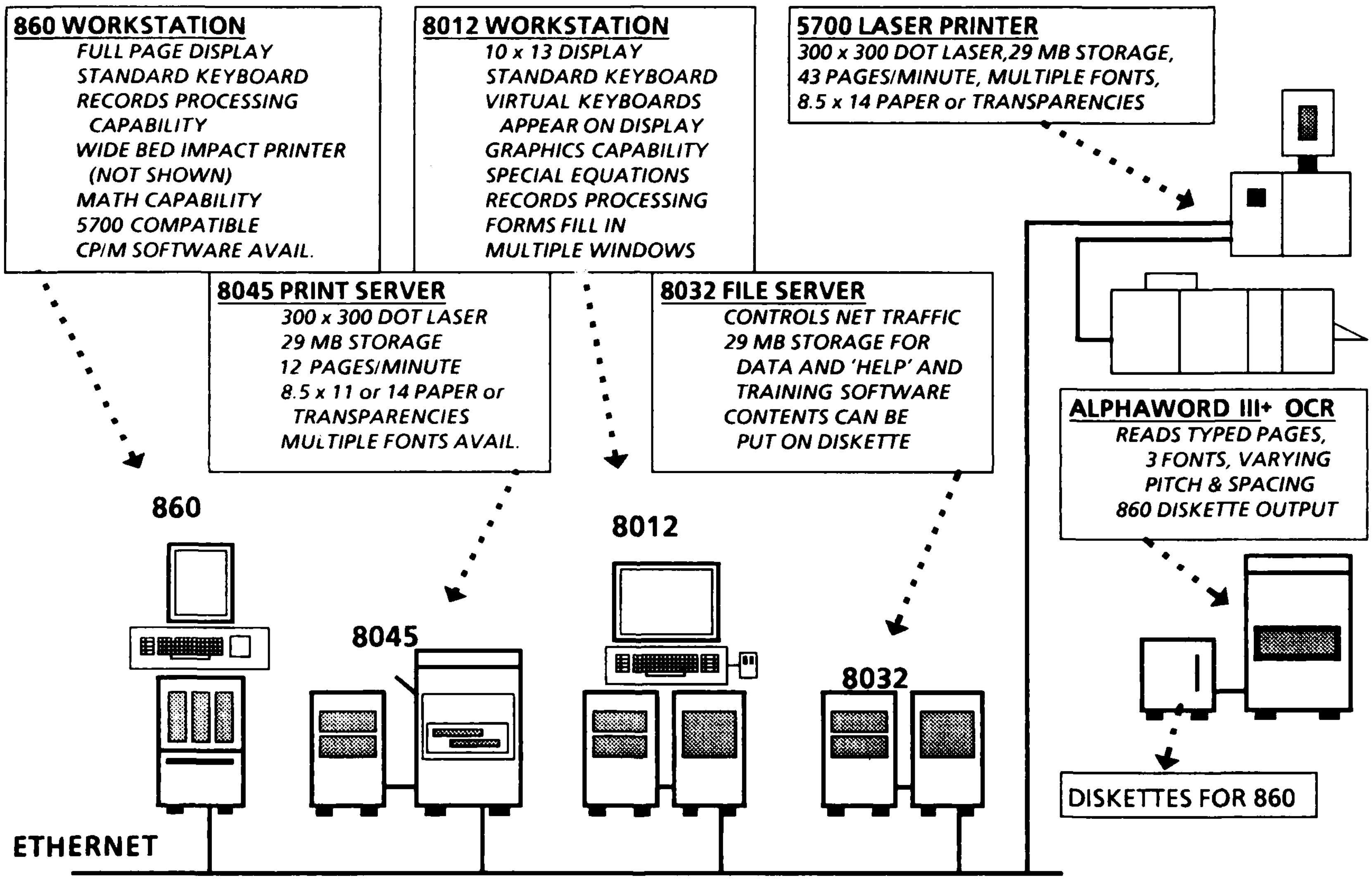


Figure 1. The System

DO WE NEED ALL THIS???

The STAR is part of a larger system. It is only one workstation on that system, sharing resources with all the other workstations. For our purposes, all we need is the group of items shown at the right. We created this figure by copying it from figure 1 and enlarging it. The small figure (upper corner) is a reduced copy.

DISPLAY (10 x 13 SCREEN)

KEYBOARD AND "MOUSE"

(LEFT) PROCESSOR

(RIGHT) DISK DRIVE

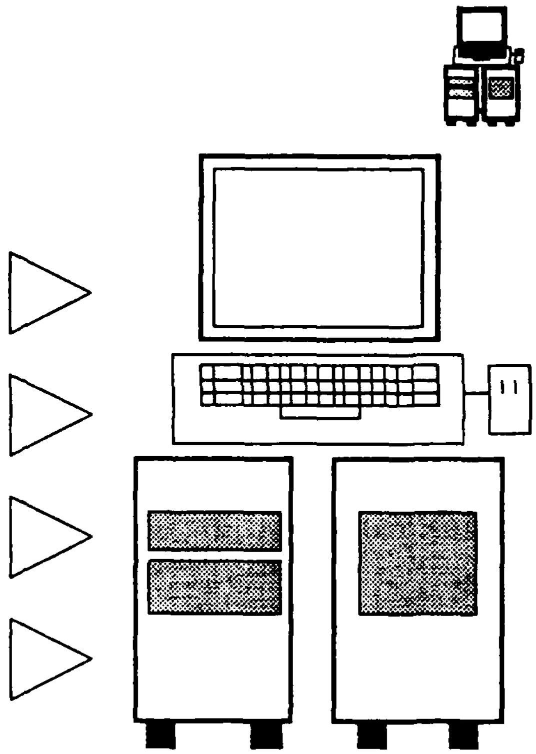


Figure 2. STAR Workstation

(We do need the file and laser printer for output, but this document was created at the workstation keyboard without use of the other equipment. We also need the ETHERNET (coax cable) link between the units.)

ONE USE FOR STAR'S GRAPHICS CAPABILITY IS ILLUSTRATED BELOW..

Gantt charts are widely used for milestone schedules in data, configuration, and publications management plans as well as other program documents.

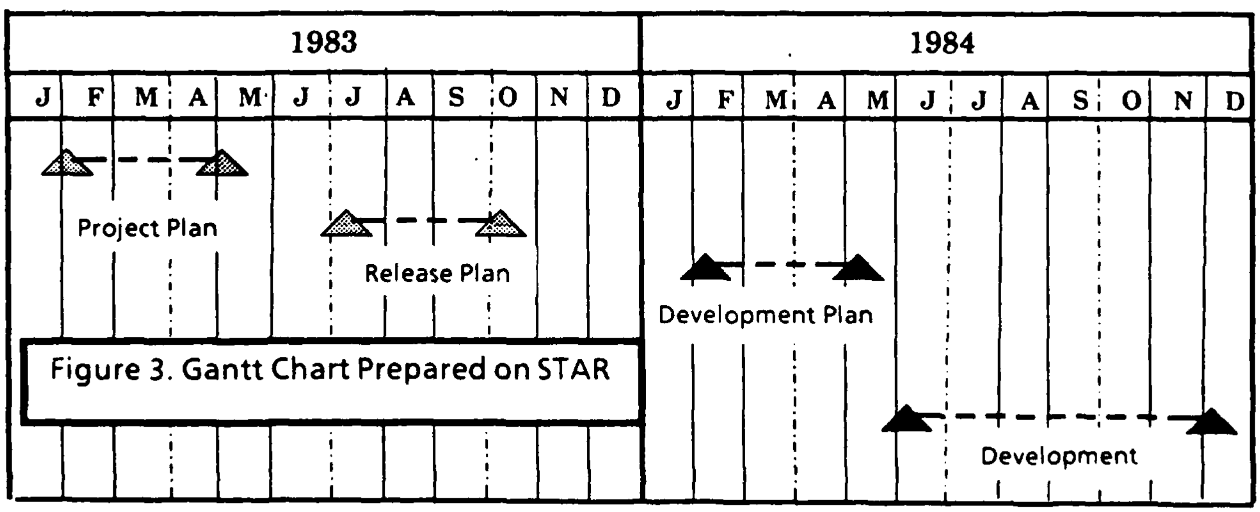


Figure 3. Gantt Chart Prepared on STAR

ANOTHER FREQUENT USE IS THE PREPARATION OF SLIDES...Such as the two shown below. ***OTHER STAR PRODUCT EXAMPLES*** appear at the end of this paper. These examples include both some we prepared and some applications examples obtained from XEROX.

available functions

document creation,editing,and printing

mailing and filing

graphics

records processing

forms

equations

emulations

Figure 4. "Functions" Slide

OPERATION SUMMARY

LOG ON...NAME AND PASSWORD

RECALL DESKTOP

CREATE/MODIFY DOCUMENT

PRINT,FILE,MAIL DOCUMENTS

LOG OFF, STORE/CLEAR DESKTOP

Figure 5. "Operations" Slide

LEARNING TO USE THE STAR.......

XEROX does not normally conduct formal training classes for STAR operators... there are so many possible applications that they'd be hard-pressed to give generalized training. Some STAR training is given as a part of the formal "system administrator" training for ETHERNET. Most user training is done by the operators themselves, using the STAR software and learning at their own pace.

An "INTRODUCTION" offered at log-on time allows the first-time (or infrequent) user to get started. There are three reference books:" Learner's Guide", "Quick Reference Guide", and a complete "Reference Guide" but for the most part the "trainee" will be looking at the display. Training segments can be selected to suit needs. Users can start and stop where they wish. Each segment includes examples and exercises, a few give "quizzes."

........HOW LONG DID IT TAKE???

When someones asks me how long I spent learning to use the STAR, I must confess that I'm still learning. (Any STAR user in this audience could teach me something.) To run through all of the training segments, doing all of the exercises, and taking each quiz will take at least a week. Hands-on experience with another system may lessen the time needed.

OPERATIONAL SEQUENCE

Let's assume that you've gone through all of the on-line training segments and know what you want to do. The following is a summary of what you'd do to prepare a document such as this paper.

FIRST,you log-on. This is simply a matter of: pressing any key on the keyboard, typing your name, and typing your password.

OPERATIONAL SEQUENCE(contd)

SECOND, your "desktop" will appear on the screen. What you actually see are small picture-like objects called "icons" shaped to resemble file folders, in- and out-baskets, your printer, and the "directory" from which you access existing files, blank documents or folders,or transfer documents.

THIRD, you select and "open" the file and/ or document on which you're going to work. To do this, you manipulate a small device called a "mouse" on which there are two buttons. Moving the mouse over a hard surface causes an arrow-shaped cursor to move around the screen. Selections are made by clicking the buttons on the mouse. When a selection has been made, the arrow changes shape (hourglass) while the STAR is executing your commands.

FOURTH, when the STAR has done what you wanted (e.g.,"opened" -- displayed in a "window" on your screen -- the document you're working on) the arrow reappears. You can now -- using the keyboard and mouse -- do any or all of the following things:

(1) *Create a new document*

(2) *Edit an existing document*

(3) *Duplicate or move copy between documents*

There's no need to create a new document every time. Existing forms can be copied and altered. Figures and text can be lifted from one document and placed in another. Graphics can be copied from on-line "transfer" sheets.

(4) *Change properties,e.g*

- Change type
  - Font
  - Weight
  - Shape
  - Spacing
- Change line or border
  - Structure
  - Weight
- Change graphics object
  - Size
  - Texture
  - Shape
  - Shading

FIFTH, you can, either or both, print/file the document you've just worked on

THEN.... you can select another document to be worked on ..... ***OR*** log off until you need the STAR again.

STAR CAN ALSO BE USED FOR

RECORDS PROCESSING...

Including calculations, sorting, logical choices, forms fill-in etc., ***BUT setup is time-consuming***

TERMINAL EMULATION...

IBM 3270 series
TTY

ELECTRONIC MAIL...

DATA-DRIVEN GRAPHICS...

Bar Charts

THE STAR KEYBOARD

The keyboard is essentially that of a typical QWERTYtypewriter except for a few keys (< > {} []). Three groups of function keys are added. One row (top group) is above the character keys and two are at either side (right and left groups).

The use of the character keys and the top function group will be changed temporarily when certain functions are selected. The temporary functions will be displayed on the screen (virtual keyboards). This is done when entering foreign language characters, office/logic/ math symbols, and "frames" for the insertion of graphics and special equations. The top group of function keys can be used either to perform some of the graphics functions or to change fonts.

THE STAR DISPLAY

The display is a 10- by 13-inch screen on which text and graphics objects appear at almost their final (printed) size. and shape. The screen has less resolution than the printed page, but otherwise what you see is almost what you get. The icons, about one inch square, can be positioned where the operator wishes. Open documents appear in windows.

When more than one document is open, the windows are made smaller and the user sees less at one time. Up to six windows can be open at any time. Properties frames also appear in windows, but only while being used.

Figure 6 will give you some idea of what it looks like. HELP only appears when called for.

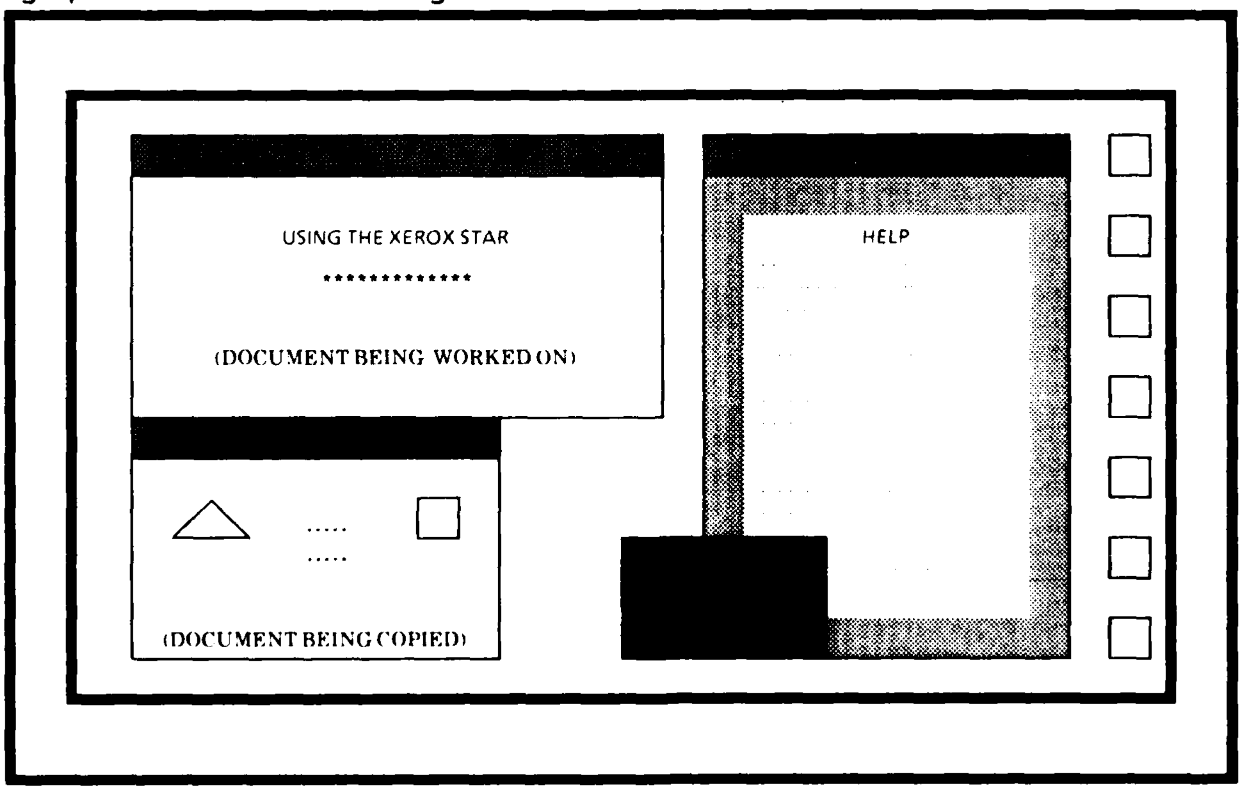


Figure 6. STAR Display

SOME APPLICATIONS OF POTENTIAL INTEREST TO DATA, CONFIGURATION, AND PUBLICATIONS MANAGERS.........

APPLICATION	*DATA*	*CONFIG*	*PUBS*
TEXT ENTRY, FORMATTING, EDITING	X	X	X
REPRODUCTION COPY MAKEUP			X
SCHEDULE CHART PREPARATION AND DATE CALCULATION	X	X	X
COST ESTIMATE CALCULATION	X	X	X
PREPARATION OF LINE ARTWORK NOT LARGER THAN 8 BY 13½			X
DIRECT KEYBOARD ENTRY OF MATH AND LOGIC EQUATIONS REQUIRING SPECIAL SYMBOLS			X
FORMS CREATION	X	X	X
SLIDE AND TRANSPARENCY PREPARATION	X	X	X
DOCUMENT COVER LAYOUT			X

CLOSING COMMENTS...

We do not intend to suggest that any or all of you run out and buy or rent a STAR.

Our experience thus far has been, for the most part, positive **BUT** the final verdict isn't in. Forthcoming software enhancements are expected to clear up most of the limitations we've encountered. XEROX appears to be committed to this product and they should have the resources to support it in whatever way is needed.

In the table above and the attached examples we've tried to cover the more likely applications as we see them. There are probably many more than we can imagine. If you have any questions, I'll try to answer them.

THE ATTACHED EXAMPLES:

PART DRAWING - *Line drawing for small, simple part*

OBJECTS,etc.,- *Prepared as large transparency, shows basic graphic objects, lines, shading,texture. "Grid Properties" are visible on display but do not print.*

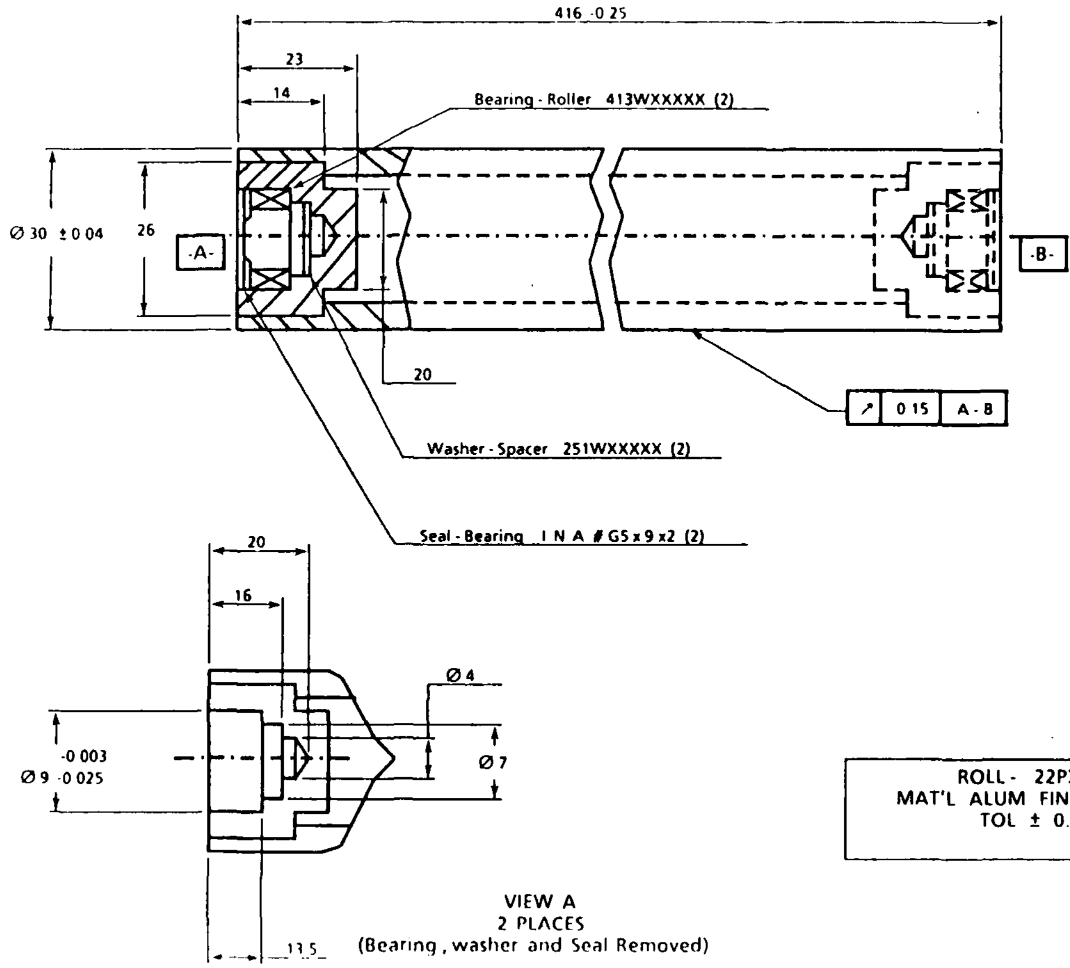
OFFICE AUTOMATION - *Shows use of shading, line work, and text entry*

USA MAP - *Done by tracing on the display.*

BEAKER GRAPH - *Uses different shapes and shadings to obtain rendered-drawing effect*

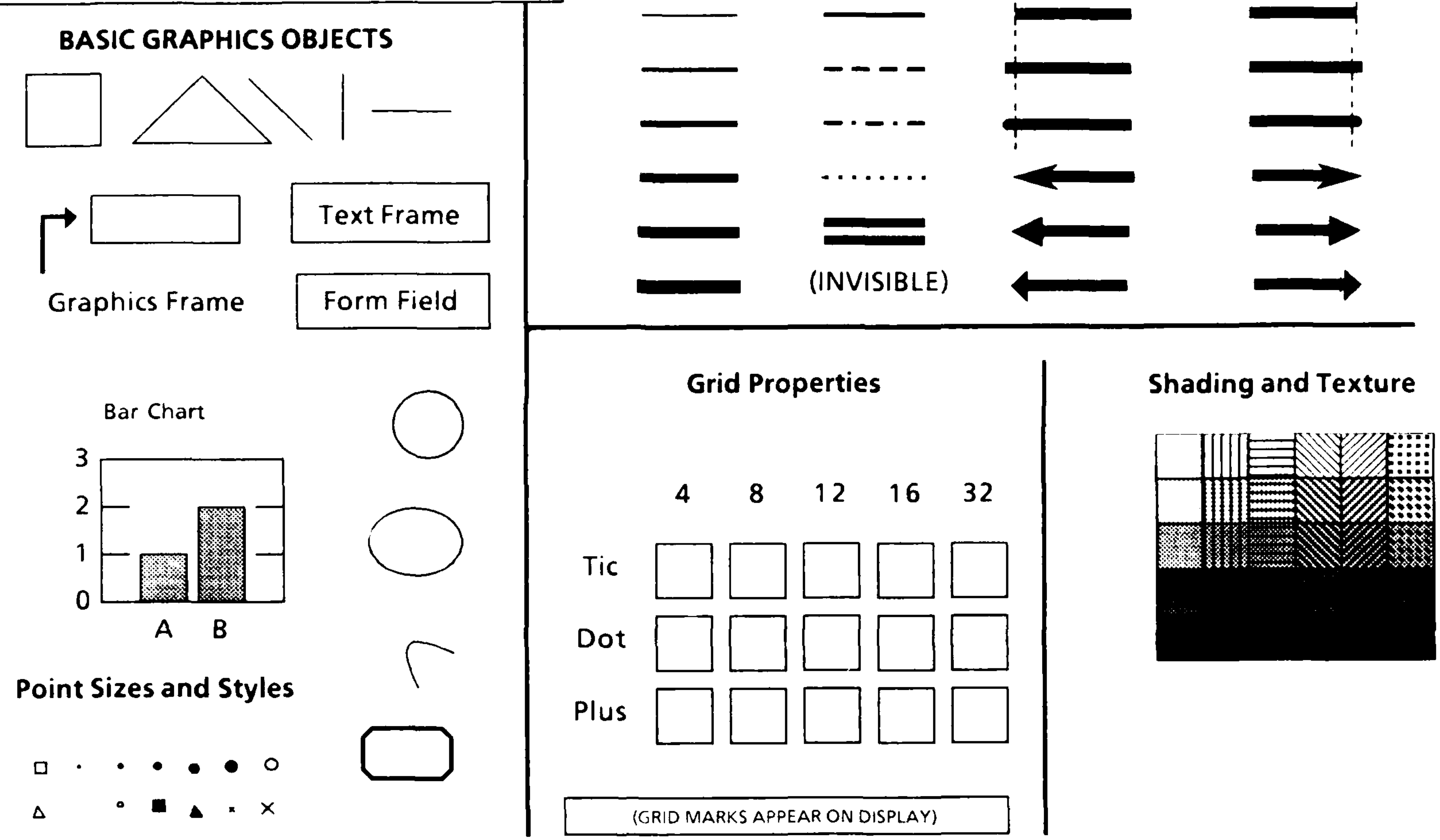
BAR GRAPH - *Example of data-driven graphics. Operator enters values and captions, selects shading and orientation, STAR plots and places graphics. Chart can be re-oriented (e.g.,horizontal to vertical) until desired presentation is obtained.*

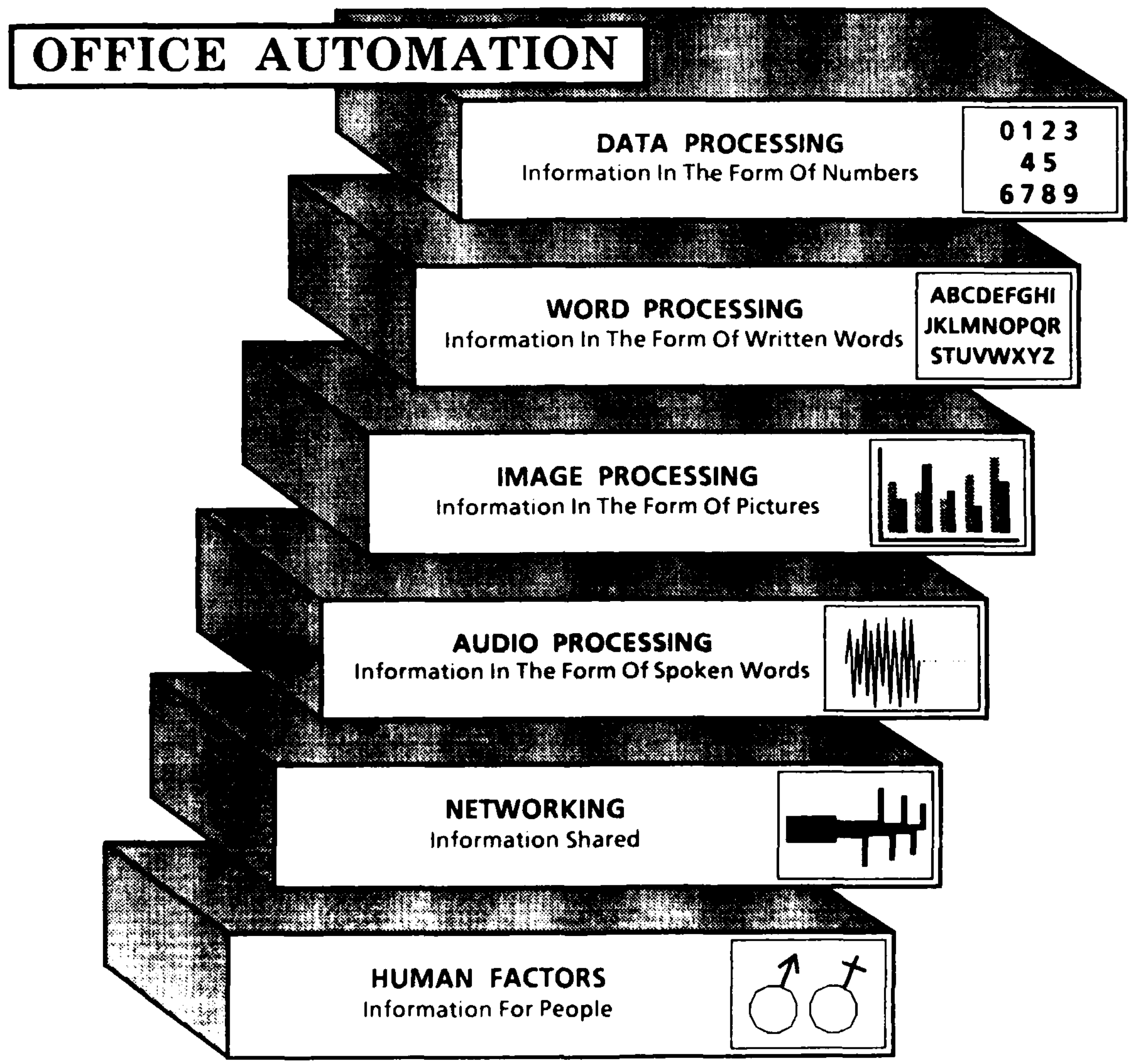
SPECIAL EQUATIONS - *Requires insertion, from keyboard, of equation frames. STAR automatically positions cursor at argument fields.*

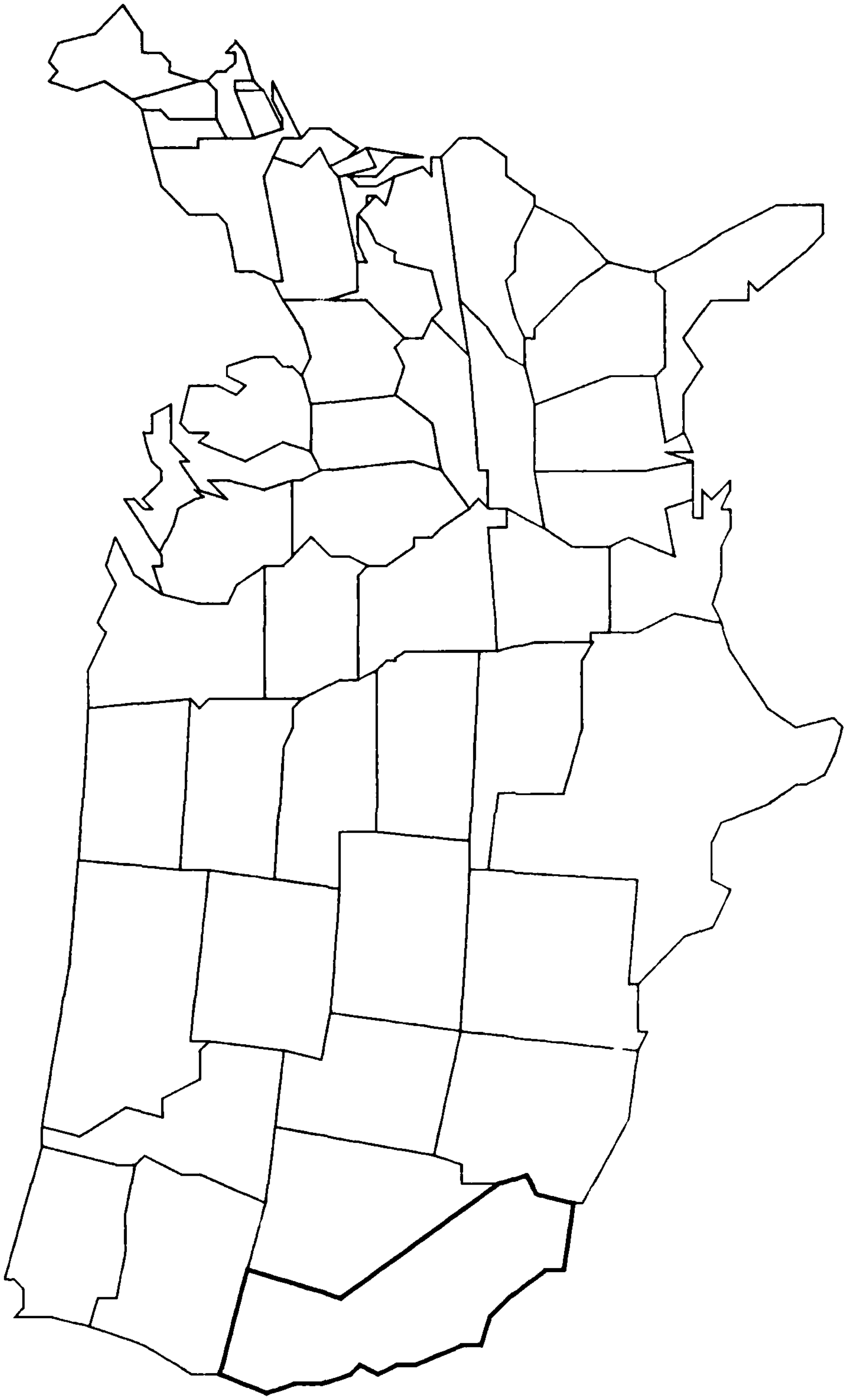


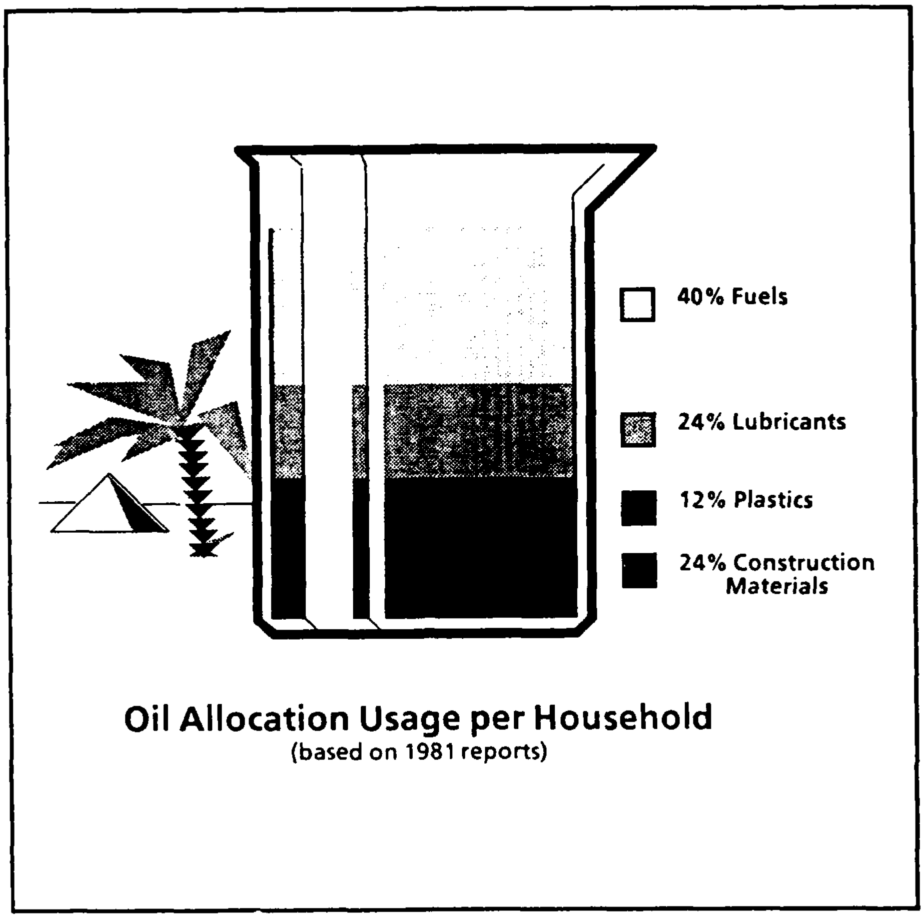
ROLL - 22PXXXX
MAT'L ALUM FINISH 50-0012
TOL ± 0.25

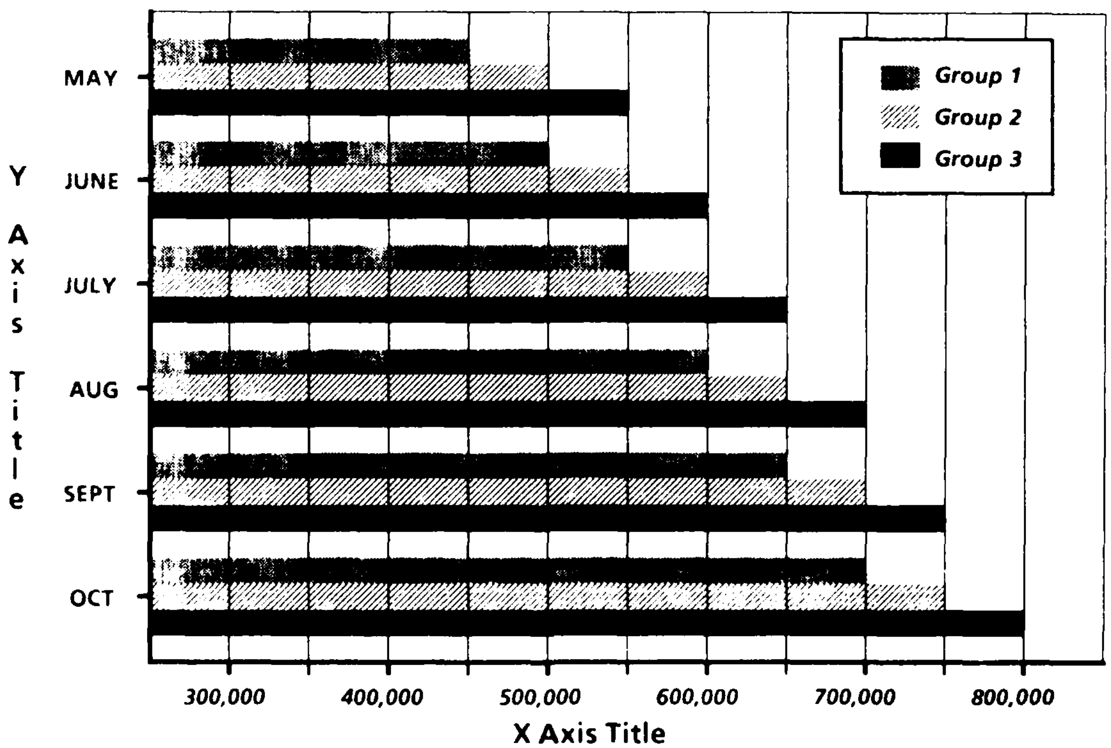
OBJECTS, LINES, SHADING,TEXTURE
(CAN BE TRANSFERRED OR COPIED)




OFFICE AUTOMATION
DATA PROCESSING
Information In The Form Of Numbers
0123
45
6789
WORD PROCESSING
Information In The Form Of Written Words
ABCDEFGHI
JKLMNOPQR
STUVWXYZ
IMAGE PROCESSING
Information In The Form Of Pictures
AUDIO PROCESSING
Information In The Form Of Spoken Words
NETWORKING
Information Shared
HUMAN FACTORS
Information For People




40% Fuels
24% Lubricants
12% Plastics
24% Construction Materials
Oil Allocation Usage per Household
(based on 1981 reports)


Group 1
Group 2
Group 3
MAY
JUNE
JULY
AUG
SEPT
OCT
Y Axis Title
300,000
400,000
500,000
600,000
700,000
800,000
X Axis Title

SAMPLE EQUATIONS

The basic problem is described by a transient one-dimensional diffusion model:

$$\frac{\partial c}{\partial t} = D \frac{\partial^2 c}{\partial x^2} \tag{1}$$

where $C(x,0) = C_o$

$C(x,t) = 0$

$\frac{\partial c}{\partial x}(0,t) = 0$

The exact solution to this equation is:

$$c(x,t) = \sum^{\infty} M_n exp(-D\lambda_n^2 t) \cos \lambda_n x \tag{2}$$

where

$$M_n = C_o \left(\frac{2 \sin \lambda_n L}{\lambda_n L + \sin \lambda_n L \cos \lambda_n L} \right)$$

The average concentration is given as:

$$C_{avg} = \frac{1}{L} \int_0^L C(x,t)\, dx = \sum_{n=1}^{\infty} (L\lambda_n)^{-1} M_n exp(-D\lambda_n 2t) \sin \lambda_n L \tag{3}$$

Since tables for concentration as a function of time for various values of x/L have been constructed, consider the ratio of C_{avg} to C(0,t), the centerline value.

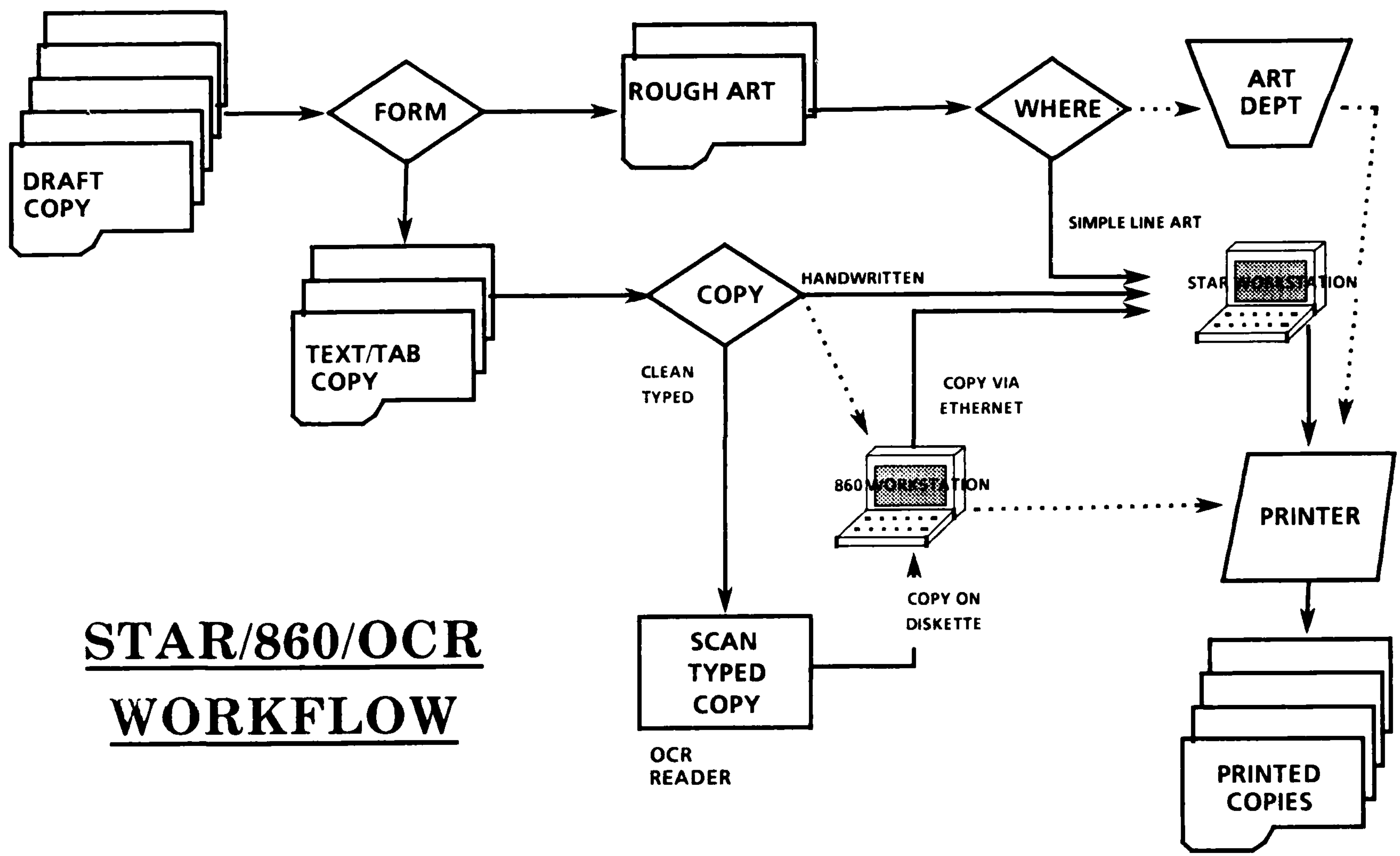
$$\frac{C_{avg}}{C(0,t)} = \sum_{n=1}^{\infty} \sin \frac{\lambda_n L}{\lambda_n L} \tag{4}$$

but it can be shown that:

$$\lambda_n L \tan \lambda_n l = 0 \tag{5}$$

We can then show, by substituting the roots of the transcendental equation 5 into equation 4 that:

$$C_{avg} / C(0,t) = 0.533 \tag{6}$$



STAR/860/OCR WORKFLOW

TO:	E. SHRDLU	DATE:	JAN 27,1984	**DATA ALERT**

Subject Program/Contract (CODE)	ALBATROSS/N78956	(ALB)	CDRL Seq. No.	A013B
Data Item Name:	CONFIGURATION MANAGEMENT PLAN			

Your activity has been assigned primary responsibility for supplying the contract data item identified above.

Delivery of	ROUGH DRAFT	to Data Management (see name below) is required not later than Noon on	FEB 13,1984
Applicable (DID .DD Form 1664) Data Item Description is	DI-E-2035A	Data Item Description	IS NOT Modified by CDRL
Transmittal to customer is scheduled for not later than:	FEB 28,1984	Customer comments are expected on or before	APRIL 1,1984

Additional comments: SEE SOW 3.6.3.2 (a) AND PROPOSAL VOLUME 3 PARA 4.2.---- APPLICABLE TO HARDWARE,SOFTWARE,AND INTERFACE CONTROL WORKING GROUP PARTICIPATION.

Please advise immediately if added information is needed or if problem is anticipated in meeting the required submittal dates.

FROM: A. J. ZILCH/13-3/3241

Name/Location/Extension

COPIES:

I.A.PHINQUE	K.K.ROSS
Engineering	PMO
D.R.SCHULTZ	L. McDEVITT
Editing/Quality	Other

DATA ALERT

PROTECTION AND CONTROL

- BACKUP ON DISKETTES
- MASTER COPY IN CONTROLLED "LIBRARY"
- "PRINT-FORMAT" DOCUMENTS DELIVERED, DISTRIBUTED, ACCESSIBLE ON-LINE
- USE "TIME-DATE" FEATURE WITH OTHER IDENTIFICATION

STATUS

MIL-STD-885

PROCUREMENT DATA PACKAGES

A Presentation To

AMERICAN DEFENSE PREPAREDNESS ASSOCIATION

9 May 1984

San Antonio, Texas

By

CHARLES J. McARTHUR

ASD/ALXL
Wright-Patterson AFB Ohio
AUTOVON 785-2659
Commercial (513) 255-2659

(Preparing Activity and Air Force Custodian for MIL-STD 885)

K

INTRODUCTION

In addressing the status of any activities associated with proposed changes to MIL-STD-885B, Procurement Data Packages, I would beg your indulgence for a brief overview of the need for Procurement, Acquisition or the more familiar Reprocurement Data. I'd like to extend credit to Mr. Chuck Feely as the source for some of the background I'll be discussing. He said it so well in his Data Management Course at AFIT, I could not improve on it.

I would like to quote a sentence from U.S. Code 10, 2304:

"The Secretary of Defense is hereby directed that insofar as practical, all contracts shall be formally advertised and awarded on a competitive bid basis to the lowest responsible bidder."

This quotation does not allow for much wandering from its principle intent, does it? The only caveat is "insofar as practical," and to date there is no universal interpretation of exactly how far we in the DOD have to go before we deem a procurement can and should be competitive rather than being awarded sole-source. From a data managers viewpoint, however, the caveat really states "whenever an appropriate data package exists". In a nut shell, a good data package is the whole secret behind an effective reprocurement. THE HEART OF COMPETITIVE PROCUREMENT IS DATA.

BACKGROUND

Let's put things into some sort of perspective. When we in DOD procure and field systems and equipment such as aircraft, ships, tanks, missiles and the thousands of other items, it is done with the full realization that there are subparts that will wearout or fail under operation, be broken or damaged during shipping and handling and need to be replaced, in order to return the system or end item to a serviceable or useable state. These subparts will be procured many times over during the life of the system or end item thus the term Reprocurement was coined to indicate a buy subsequent to the buy or the initial provider (source). Remember, the first supplier of the system or end item satisfies the DOD's requirements through someones part number, either his own or some other manufacturers or source of supply. DOD by virtue of U.S. Code 10 and good business sense, does not want to be limited to just one part number or source because of many reasons such as the company going out of business, deciding against future involvement with a particular part number, errosion of quality, price-jabbing, and many others. We in DOD would like to have multiple sources of supply for every subpart we need to buy, whereas many companies want to be the sole-source or only supplier because they believe that future profits can be assured since they know and can predict wear out and replacement quantities hence guaranteed business. The DOD must compensate an initial provider of the major item for identifying which parts and subparts can be bought on a separate basis and in accordance with the quantities estimated. This identification requires information or data to completely define the physical and functional attributes of the subpart, its manufacturing techniques plus all other data that will permit the subpart to be provided by any competent source in the same physical or functional characteristics as that made by the original source. These concepts are the basis for what we in the acquisition business, both government and industry call "item breakout". The basic steps to accomplish item breakout are:

1. DOD satisfaction with the initial system or end item (aircraft, ship, etc.) and its subparts that make up that system or end item.

2. Identification of these subparts that will be needed as spare and repair parts during the life of the system or end item.

3. Ability to obtain comprehensive, accurate, and descriptive information on the subparts identified as spare and repair parts. These data must include material specifications, manufacturing processes, testing, lists of many kinds, and packaging, handling, preservation and transportation variables.

4. The capability of another manufacturer to provide ostensibly the same functional and physical interchangeable or identical subpart. We must remember that in addition to reaping any monetary savings through item break-out and competition reprocurement, we must insure second or alternate sources for all spare and repair parts to maintain system support and readiness.

DOD Acquisition Improvement Program (AIP) initiative six directs all acquisition management activities to establish appropriate program objectives to enhance competition for our supplies and services. As stated earlier, the heart or foundation of any procurement action, including reprocurement is the combination of data and information necessary to describe an item so that either an identical or interchangeable item can be procured.

Since 1979, the Air Force has been investigating the causes for sharp increases in prices paid for certain spare and repair parts. The investigation highlighted that for various reasons, the Air Force does not and could not take maximum advantage of competition market forces in executing its spares acquisition programs. These investigations coupled with recent congressional pressures led to the chartering of the Air Force Management Advisory Group (AFMAG). The AFMAG was a study conducted last fall of the Air Force Acquisition process. The study highlighted the need for development of methods to ensure fair and reasonable prices and increased competition for spare and repair parts.

AFMAG ACTIVITIES

The study found that the process of defining contract requirements for procurement data packages is complex and unwieldy, often resulting in incomplete and unuseable data. This limits the DOD's ability to competitively procure spare and repair parts. One of the key factors causing this problem has been the ambigeous methods of describing and delivering what constitutes an adequate procurement data package.

Over the past 10-12 years, there has been a constant change in the methods and techniques used to define engineering data requirements in directives, regulations, and other policy documentation. Prior to 1975, the primary description of engineering data was contained in MIL-D-1000, Engineering Drawings and Associated Lists. This document established requirements for drawings in terms of categories of use (content) and form (format). Description of data was provided by individual data item descriptions for each of ten separate categories of use. In 1971, the Air Force, in an attempt to streamline this process prepared MIL-STD-885, that would call out a procurement data list, and an attendant DID (DI-E-3472, Procurement Data Packages) that provided the data including all engineering data.

In 1975, a major change was made to MIL-D-1000 to clarify and simplify the description of engineering drawings. MIL-D-1000A, described drawing content in terms of levels of program development. It describes the development of

an engineering drawing system as an evolutionary process progressing in greater detail through the concept (Level 1), prototype production (Level 2), and production phases (Level 3) of a system or equipment development. Further, instead of ten separate data item descriptions under the pre-1975 system, one data item description would be used to obtain drawings. As a result of these changes and the subsequent revision to MIL-D-1000 and MIL-STD-100, it became apparent to the AFMAG that MIL-STD-885 had not kept pace with changes to these specifications, standards and their associated data item descriptions. The AFMAG recommended that MIL-STD-885 be updated and revised to correlate it with existing and proposed changes to engineering data policy, and provide updated guidance for the content and delivery of procurement data packages.

As the Preparing Activity and Air Force custodian for MIL-STD-885, I called a meeting of joint service and industry representatives in March to charter a work group and establish the ground rules and schedules for revising MIL-STD-885.

PLANNING MEETING

After a brief review of DOD, and service directives, specifications, and standards relating to engineering and procurement data, the meeting was placed on open floor discussion on engineering drawings, engineering data, and the data necessary to permit competitive procurement of an item. After much discussion, it became apparent that there are varied interpretations of what engineering drawings, engineering data, and procurement data are. It was also apparent that there are different methods for obtaining procurement data lists and packages.

Ted Golmis, representing industry through ADPA, advised the group that industry in general believes drawings prepared to Level 3 provide all information required to manufacture an item for production. He also pointed out that other data such as corrosion control, some acceptance test and packaging, handling, and transportation data is not delivered as engineering data but is required for competitive procurement.

A concensus was reached that in addition to Level 3 drawings, procurement data lists, and other procurement data are also needed for competitive procurement of spare and repair parts. Mr. Golmis stressed the fact that the government is already privy to all engineering data and drawings, but that out biggest problem was communication. We need to zero in on what it is we really want, what do we think we are asking for, and how do we want to document and deliver this information.

SUMMARY

Based on what I just finished saying, it is apparent that a strong need exists for a document such as MIL-STD-885. To that end, I have started on a draft revision to the MIL-STD and its data item description. Recognizing the problems involved in coordinating a document through the Air Force, and the even tougher hoops in a joint service and industry effort, I am confident and optomistic that we can have a coordinated document ready for publication by next year.

I am also asking the Defense Materiel Specification and Standards Office (DMSSO) to initiate a project to evaluate the various methods and documents used by the services for obtaining procurement data lists and packages, and recommend a single standard or uniform method to be used by all DOD components. To pull all of this together I solicit your strong support and active involvement in reviewing and commenting on the proposed draft scheduled for release in late July.

TECHNICAL DOCUMENTATION

AS RELATED TO

COMPETITION

CAPTAIN THOMAS J. BURKE, USN

COMMANDING OFFICER, NAVAL SEA SYSTEMS
COMMAND LOGISTICS SUPPORT
ENGINEERING ACTIVITY

OFFICER IN CHARGE, NAVAL ELECTRONIC
SYSTEMS COMMAND DETACHMENT
MECHANICSBURG

ENGINEERING/TECHNICAL ASSISTANT TO
COMMANDING OFFICER, SPCC
P. O. BOX 2020
MECHANICSBURG, PA 17055
717-690-2711

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GOOD MORNING LADIES AND GENTLEMEN. IT IS A DISTINCT PLEASURE FOR ME TO BE HERE AT THE 26TH ANNUAL MEETING OF THE TECHNICAL DOCUMENTATION DIVISION OF THE AMERICAN DEFENSE PREPAREDNESS ASSOCIATION, AND TO REPRESENT THE U.S. NAVY. I MUST ADD THAT I ALSO REPRESENT THE CENTRAL PENNSYLVANIA MANAGEMENT CHAPTER OF ADPA LOCATED IN MECHANICSBURG, PENNSYLVANIA, WHERE I AM A MEMBER IN GOOD STANDING, AND HAVE BEEN NOMINATED FOR THE CHAPTER PRESIDENCY FOR OUR ELECTION IN JUNE.

SOME OF YOU MAY RECALL THAT I SPOKE TO THIS ASSEMBLAGE LAST YEAR AT FORT MONROE, VA. TO BE ASKED BACK MAKES ME FEEL ESPECIALLY GOOD BECAUSE SOMETHING I SAID MUST HAVE STRUCK HOME, AT LEAST TO SOMEONE. WHEN I WAS ASKED TO SPEAK TO YOU AGAIN THIS YEAR AND ASKED TO SELECT A TOPIC, I QUICKLY CHOSE A SUBJECT WITH WHICH I HAVE BECOME DEEPLY INVOLVED, ESPECIALLY WITH REGARD TO THE REPROCUREMENT OR REPLENISHMENT OF SPARE PARTS FOR EQUIPMENTS ON BOARD SURFACE SHIPS AND SUBMARINES. ONLY AFTER I GAVE MY TOPIC TO TED GOLMIS AND REVIEWED MY REMARKS FROM LAST YEAR, DID I REALIZE THE SIMILARITY BETWEEN MY LAST YEAR'S SUBJECT AND MY CHOICE FOR THIS YEAR.

"(TECHNICAL) DOCUMENTATION AS RELATED TO COMPETITION," IS A FOLLOW-ON TO "COMPETITION AND COOPERATION." THUS, SPEAKING TO YOU FOR THE SECOND TIME GIVES ME AN OPPORTUNITY WHICH FEW SPEAKERS HAVE--THE CHANCE TO FOLLOW-UP ON WHAT I SAID A YEAR AGO. TO DO SO, I NEED TO REVIEW SOME OF THE KEY POINTS FROM LAST YEAR, THEN BRING YOU UP TO DATE ON MY OBSERVATIONS AND PERCEPTIONS OF THE PAST YEAR, AND FINALLY MAKE SOME SUGGESTIONS AND RECOMMENDATIONS FOR THE FUTURE.

TO AGAIN SET THE STAGE FOR MY REMARKS, AND SO THAT YOU WILL PLACE THEM IN PROPER PERSPECTIVE, I NEED TO REFRESH YOU ON A FEW THINGS ABOUT MYSELF AND THE ACTIVITIES I REPRESENT. IT IS OBVIOUS THAT SOME OF MY REMARKS WILL BE SLANTED TO AND BIASED BY MY PRESENT POSITIONS. FIRST I WOULD REMIND YOU THAT I AM NOT A SUPPLY OFFICER. I AM A SURFACE WARFARE OFFICER--A SHIP DRIVER. I AM NOT AN ENGINEER BY EDUCATION; HOWEVER, I HAVE A STRONG TECHNICAL BACKGROUND BOTH BY TRAINING AND SHIPBOARD EXPERIENCE. I CURRENTLY HAVE ASSIGNMENTS WITH THREE SEPARATE ACTIVITIES IN THE MECHANICSBURG, PENNSYLVANIA, AREA. MY PRIMARY DUTY IS AS COMMANDING OFFICER OF THE NAVSEA LOGISTICS

SUPPORT ENGINEERNG ACTIVITY, A NAVAL SEA SYSTEMS COMMAND FIELD ACTIVITY. I HAVE AN ADDITIONAL DUTY ASSIGNMENT AS OFFICER IN CHARGE, NAVELEX DETACHMENT IN MECHANICSBURG, A NAVAL ELECTRONICS SYSTEMS COMMAND FIELD ACTIVITY. THESE ACTIVITIES ARE DEEPLY INVOLVED IN THE PROVISIONING PROCESS FOR HULL, MECHANICAL AND ELECTRICAL EQUIPMENTS, AS WELL AS SEARCH RADARS, SONARS AND TACTICAL COMPUTERS FOR NAVSEA, AND FOR ALL NAVELEX EQUIPMENTS. IN ADDITION, BOTH ACTIVITIES PROVIDE ENGINEERING SERVICES TO NAVY SHIPS PARTS CONTROL CENTER (SPCC) FOR RESOLUTION OF TECHNICAL PROBLEMS RELATED TO SPARE PARTS PROCUREMENT.

WITHIN THIS PAST YEAR, BOTH ACTIVITIES HAVE BEEN ASSIGNED THE TASK OF REVIEWING SPARE PARTS TECHNICAL DOCUMENTATION PACKAGES IN SUPPORT OF THE DEPARTMENT OF DEFENSE "BREAKOUT PROGRAM" AS IMPLEMENTED WITHIN THE NAVY. OUR TASK IS TO DETERMINE IF THE DOCUMENTATION AVAILABLE TO THE NAVY SUPPLY SYSTEM IS ADEQUATE TO PROCURE SPARE PARTS THROUGH UNRESTRICTED COMPETITION, AND IF THE DOCUMENTATION IS NOT ADEQUATE, TO OBTAIN OR DEVELOP SUCH DOCUMENTATION WHICH IS REQUIRED TO MAKE THE ITEM SUITABLE FOR COMPETITION IF IT IS ECONOMICALLY VIABLE TO DO SO -- THAT IS, IF THERE WILL BE A NET SAVINGS THROUGH COMPETITION AFTER CONSIDERING THE COSTS TO

OBTAIN OR DEVELOP THE REQUIRED DATA. MORE ABOUT THIS LATER.

I LIKE TO REFER TO MY PEOPLE, MOST OF WHOM ARE ENGINEERS, AS INTERPRETERS BETWEEN THE ACQUISITION MANAGERS IN NAVSEA AND NAVELEX AND THE SUPPLY SYSTEM, PRINCIPALLY SPCC AS THE PRIMARY INVENTORY CONTROL POINT FOR SHIPS. INTERPRETERS OBVIOUSLY SPEAK AT LEAST TWO LANGUAGES; THUS, MY ENGINEERS, IN ADDITION TO BEING QUALIFIED IN THEIR OWN LANGUAGE, ALSO SPEAK "SUPPLY". A LANGUAGE WHICH IS FOREIGN TO MOST OF THOSE IN THE ACQUISITION BUSINESS.

MY THIRD POSITION, ANOTHER ADDITIONAL DUTY ASSIGNMENT, IS AS ENGINEERING/TECHNICAL ASSISTANT TO THE COMMANDING OFFICER OF SPCC, COMMODORE ROBERT B. ABELE, SC, USN.

I WOULD LIKE TO REMIND YOU THAT IN THE SHIPS' WORLD WE HAVE TWO GENERAL CATEGORIES OF EQUIPMENTS -- GOVERNMENT FURNISHED AND CONTRACTOR FURNISHED. MOST OF YOU ARE MORE CLOSELY ASSOCIATED WITH THE GOVERNMENT FURNISHED EQUIPMENTS WHICH ARE MOST OFTEN INTRODUCED TO THE FLEET THROUGH THE R&D CYCLE WITH THE NAVY FREQUENTLY PARTICIPATING IN OR PROVIDING FUNDING FOR THE DESIGN PROCESS. IN MANY CASES, THE NAVY ACTUALLY ACQUIRES A MAJORITY OF THE TECHNICAL DATA OR THE RIGHTS TO THAT DATA.

MOST OF THESE EQUIPMENTS FALL INTO THE ELECTRONIC OR ORDNANCE CATEGORIES. HOWEVER, THERE ARE SOME HULL, MECHANICAL AND ELECTRICAL (HM&E) EQUIPMENTS SUCH AS PROPULSION GAS TURBINES, WHICH ALSO FALL INTO THIS GOVERNMENT FURNISHED CATEGORY. CONTRACTOR FURNISHED EQUIPMENT IS SUPPLIED BY THE SHIPBUILDER TO MEET PERFORMANCE SPECIFICATIONS CALLED OUT IN THE SHIPBUILDING CONTRACT. THESE ARE FREQUENTLY OFF-THE-SHELF, COMMERCIAL, MARINE APPLICABLE HM&E EQUIPMENTS; BUT NOT ALWAYS. IN RECENT YEARS, WE HAVE SEEN MORE SMALL ELECTRONIC ITEMS, INTERCONNECTING DEVICES, REMOTE CONTROL UNITS AND OTHER PERFORMANCE SPECIFICATION ITEMS BEING PROVIDED BY THE SHIPBUILDER. THE MAIN POINT HERE IS THAT ALMOST ALL CONTRACTOR FURNISHED EQUIPMENT IS PROCURED TO PERFORMANCE SPECIFICATIONS WITH LITTLE TO NO STANDARDIZATION. SINCE NAVY GENERALLY HAD NO PART IN THE DEVELOPMENT OF THESE EQUIPMENTS, AND DOES NOT NORMALLY CONTROL THE EQUIPMENT DESIGN, THE GOVERNMENT GENERALLY DOES NOT OWN THE RIGHTS TO TECHNICAL DATA, AND FREQUENTLY THE EQUIPMENT MANUFACTURER REFUSES TO SELL SUCH DATA TO NAVY.

LAST YEAR, I USED A SIMILAR PREAMBLE TO LEAD INTO MY TWO PRINCIPAL THEMES -- COMPETITION AND COOPERATION.

YOU ARE ALL AWARE OF THE INCREASING PRESSURES PLACED ON THE DEPARTMENT OF DEFENSE BY THE CONGRESS TO INCREASE COMPETITION FOR SPARE PARTS. YOU HAVE ALL BEEN EXPOSED TO AT LEAST SOME OF THE TELEVISION AND PRINT MEDIA EXPOSES AND THE EXAMPLES GIVEN WHICH WERE INTENDED TO SHOW MILITARY WASTE. YOUR COMPANY MAY HAVE BEEN ONE OF THOSE ACCUSED OF PRICE GOUGING AND EXCESSIVE PROFITEERING ON THE SALE OF SPARE PARTS TO THE MILITARY. IN MANY OF THE EXAMPLES, THE EXPOSE WAS CORRECT. COMPETING THE ITEM WOULD HAVE RESULTED IN A LOWER PRICE. THEN, WHY DIDN'T WE, OR YOU WHEN YOU PURCHASED IT FOR US, COMPETE THE ITEM? I DID NOT ATTEMPT TO ANSWER THAT QUESTION FOR ALL CASES LAST YEAR AND I AM NOT GOING TO ATTEMPT TO DO SO NOW, BUT I DID MENTION ONE MAJOR REASON. THE OBSTACLE TO COMPETITION OF WHICH I SPOKE WAS THE LACK OF ADEQUATE TECHNICAL DOCUMENTATION.

I TOLD YOU LAST YEAR THAT ALL TOO OFTEN, THE TECHNICAL DATA DELIVERED TO THE NAVY DID NOT DISCLOSE SUFFICIENT DETAIL TO SUPPORT REPROCUREMENT OF IDENTICAL SPARE AND REPAIR PARTS FROM OTHER THAN THE PRIME CONTRACTOR. I ALSO TOLD YOU THAT THIS WAS THE USUAL SITUATION WITH REGARD TO CONTRACTOR FURNISHED

EQUIPMENT, BUT THAT IT WAS ALSO FREQUENTLY THE CASE WITH GOVERNMENT FURNISHED EQUIPMENT, EVEN THOUGH THE NAVY SUPPOSEDLY BOUGHT THE REQUIRED DATA. MORE ON THIS LATER, ALSO.

LAST YEAR I ASKED A NUMBER OF QUESTIONS WHICH I OBVIOUSLY DIDN'T EXPECT TO BE ANSWERED THEN. HOWEVER, OVER THE PAST YEAR I HAVE GOTTEN ANSWERS, IN ONE FORM OR ANOTHER TO MOST OF THOSE QUESTIONS. I'M GOING TO REPEAT SOME OF THOSE QUESTIONS, AND PROVIDE SOME ANSWERS BASED ON MY OBSERVATIONS.

Q. HOW MANY OF YOUR COMPANIES ASSIGN YOUR OWN PART NUMBER TO ALL PARTS IN EQUIPMENT YOU PRODUCE EVEN THOUGH YOU DO NOT MAKE ALL THE PARTS YOURSELF BUT PURCHASE THEM FROM SOME VENDOR OR VENDORS?

A. AFTER ASKING THIS QUESTION I HAD MANY OF YOU TELL ME THAT YOUR COMPANY ASSIGNED ITS OWN PART NUMBER FOR INTERNAL IDENTIFICATION AND CONTROL. THAT CERTAINLY IS A LOGICAL AND VALID REASON, AND ONE WITH WHICH I AGREE. HOWEVER, WHAT WE HAVE FOUND IS THAT IN TOO MANY CASES THE ONLY PART NUMBER WHICH IS SUPPLIED TO US IS THE PRIME EQUIPMENT MANUFACTURER'S PART NUMBER. ALL TO FREQUENTLY THE IDENTITY OF THE ACTUAL

MANUFACTURER OF THE PART IS NOT MADE VISIBLE. WE HAVE ALSO HAD INSTANCES WHERE THE PRIME WOULD NOT PROVIDE THE IDENTITY OF HIS SOURCES. THIS HAS MOSTLY BEEN WITH MANUFACTURERS OF COMMERCIAL MARINE MECHANICAL OR ELECTRICAL EQUIPMENTS. WE HAVE ALSO HAD CASES BROUGHT TO OUR ATTENTION WHERE A SUPPLIER CAME TO US STATING HE MADE A PART FOR AN EQUIPMENT MANUFACTURER WHEN THAT MANUFACTURER HAD INDICATED THAT HE MADE THE PART HIMSELF. WE ARE STILL INVESTIGATING A COUPLE OF THESE SITUATIONS.

SO IN ANSWER TO MY QUESTION, I WOULD SAY THAT MOST COMPANIES WHO ASSIGN THEIR OWN PART NUMBERS DO SO FOR VALID REASONS. ALTHOUGH SOME, GENERALLY UNINTENTIONALLY, HAVE ALLOWED THEIR INTERNAL PROCEDURES AND CONTROLS TO MASK THE ACTUAL SOURCE OF PARTS IN DATA SUPPLIED TO THE NAVY. UNFORTUNATELY, HOWEVER, THERE ARE SOME WHO INTENTIONALLY WITHHOLD THIS INFORMATION.

Q. HOW MANY OF YOUR COMPANIES PURPOSELY LEAVE SOME OF THE DETAILS OF A MANUFACTURING PROCESS, QA REQUIREMENT, TEST PROCEDURE OR MATERIALS REQUIREMENT OFF A PART DRAWING SO WE WILL HAVE TO COME BACK TO YOU TO BUY THE PART?

A. UNFORTUNATELY, FEW PARTS DRAWINGS WHICH WE HAVE REVIEWED

ARE TOTALLY ADEQUATE FOR UNLIMITED COMPETITIVE PROCUREMENT. FREQUENTLY SOME OTHER DRAWING OR PROCESS OR PROCEDURAL INSTRUCTION REQUIRED TO MAKE AND/OR TEST THE PART IS REFERENCED, BUT THIS DOCUMENTATION HAS NOT BEEN PROVIDED TO THE NAVY. ALTHOUGH MOST CONTRACTORS HAVE BEEN COOPERATIVE IN SUPPLYING US WITH THE ADDITIONAL REQUIRED DOCUMENTATION, IN MANY CASES OUR ATTEMPTS TO OBTAIN THE MISSING DOCUMENTATION HAVE MET WITH RESISTANCE. EITHER THE DOCUMENTATION IS "NO LONGER AVAILABLE," CLAIMED AS PROPRIETARY, OR AN EXORBITANT PRICE IS QUOTED. IN SOME OF THESE CASES, WE HAVE DEVELOPED, OR PLAN ON DEVELOPING, THE REQUIRED ADDITIONAL DRAWINGS OR PROCEDURES OURSELVES USING OTHER DOCUMENTATION AND TECHNICAL RESOURCES AVAILABLE TO USE. IN A SENSE, A FEW OF THESE INSTANCES HAVE BEEN ALMOST COMICAL BECAUSE AS WE INVESTIGATED WE HAVE FOUND THE IDENTICAL PART IN QUESTION USED ELSEWHERE, IN OTHER EQUIPMENT MANUFACTURED BY THE RECALCITRANT COMPANY OR IN ANOTHER PRIME'S EQUIPMENT, AND IDENTIFIED BY ANOTHER STOCK NUMBER SUPPORTED BY COMPLETELY ADEQUATE DOCUMENTATION WITHOUT RESTRICTIONS. THIS SUPPORTS THE NEED FOR A UNIVERSAL IDENTIFICATION AND CONTROL SYSTEM (UNICS). RIGHT, TED? SO IN THIS INSTANCE, THE VERY SITUATION WHICH WE ARE TRYING TO SOLVE ELSEWHERE: THAT OF

MULTIPLE IDENTIFICATION OF PARTS AND THE MULTIPLE ASSIGNMENT OF STOCK NUMBERS: ALLOWED US TO OBTAIN REQUIRED DOCUMENTATION. HOWEVER, IT FURTHER RAISES QUESTIONS AS TO HOW MUCH DOCUMENTATION DUPLICATION AND REDUNDANT DATA DOES EXIST. IF WE BETTER IDENTIFIED PARTS AS THEY ARE BROUGHT INTO THE SUPPLY SYSTEM AND AVOIDED IDENTIFICATION DUPLICATION, WE COULD TAKE A VERY SIGNIFICANT STEP WHICH WOULD REDUCE TECHNICAL DOCUMENTATION COSTS AND HAVE THE POTENTIAL OF FURTHER REDUCING SPARE PARTS COSTS.

BY AND LARGE MOST COMPANIES HAVE BEEN COOPERATIVE AND REASONABLE, BUT UNFORTUNATELY, SOME HAVE NOT BEEN. SOME LOOK UPON MILITARY BUSINESS AS SUCH A SMALL PART OF THEIR TOTAL SALES THAT THEY FEEL THEY DON'T NEED TO DO ANYTHING SPECIAL FOR THAT MILITARY BUSINESS EVEN THOUGH WE PAY FOR THE EXTRAS. SOME WOULD PREFER NOT TO HAVE OUR BUSINESS AT ALL. I SUBMIT THAT WITHOUT THAT SMALL PERCENTAGE OF BUSINESS WHICH COMES FROM THE MILITARY, THOSE COMPANIES MIGHT ONE DAY HAVE NO BUSINESS AT ALL.

Q. HOW MANY OF YOUR COMPANIES CONSCIOUSLY STRIVE TO GET YOURSELF INTO THE POSITION OF BEING THE SOLE SOURCE FOR SPARE PARTS AND THEN CHARGE EXCESSIVELY HIGH PRICES FOR THOSE PARTS?

A. I HATE TO SAY THIS, AND I REALLY HOPE I'M WRONG, BUT JUDGING FROM THE AMOUNT OF TECHNICAL DOCUMENTATION REVIEWED BY MY PEOPLE WHICH HAS BEEN JUDGED AS INADEQUATE FOR COMPETITIVE PROCUREMENT, IT APPEARS THAT QUITE A FEW EQUIPMENT MANUFACTURERS HAVE IN ONE WAY OR ANOTHER IDENTIFIED THEMSELVES AS THE SOLE SOURCE FOR MANY SPARE PARTS AND HAVE, IN MANY CASES, MISPRICED THOSE PARTS WE HAVE IDENTIFIED. MANY OF THE PARTS IN THIS CATEGORY THAT COULD READILY BE MADE BY OTHER MANUFACTURERS GIVEN ADEQUATE DRAWINGS AND OTHER DOCUMENTATION. AS A RESULT OF ALL THE VISIBILITY OF AND PRESSURES ON SPARE PARTS ISSUES, THIS SITUATION SEEMS TO BE CHANGING.

Q. HOW MANY OF YOUR COMPANIES PROFIT MORE ON GOVERNMENT SALES THAN COMMERCIAL SALES?

A. I DON'T REALLY WANT TO ATTEMPT TO ANSWER THIS QUESTION BECAUSE TO DO SO COULD GET ME INTO TROUBLE. I'M ON SHAKEY GROUND HERE BECAUSE DEFINITIVE DATA IS HARD TO COME BY. HOWEVER, THERE IS SOME EVIDENCE WHICH SUGGESTS THAT SOME COMPANIES HAVE SOLD PARTS TO THE MILITARY AT HIGHER PRICES THAN THEY CHARGE THEIR

COMMERCIAL CUSTOMERS FOR THE SAME PARTS. FORTUNATELY, IT DOES NOT APPEAR AS THOUGH THIS PRACTICE IS WIDESPREAD. AND, I WOULD EXPECT THAT IT WILL SOON DISAPPEAR ALTOGETHER AS A RESULT OF MEDIA VISIBILITY OF SPARE PARTS ISSUES.

Q. WHY SHOULD THE MILITARY BE PLACED IN THE POSITION OF BUYING SPARE PARTS ONLY FROM YOUR COMPANY UNLESS YOU BRING SOME SPECIAL "MAGIC" TO THAT PARTY?

A. THE SIMPLE ANSWER IS THAT THE MILITARY SHOULD NOT BE PLACED IN SUCH A POSITION. BUT ON THE OTHER HAND, THE PROCUREMENT SYSTEM MUST ALLOW FOR LIMITING THE PURCHASE OF SPARE PARTS TO PRIME EQUIPMENT MANUFACTURERS WHEN IT IS TECHNICALLY APPROPRIATE TO DO SO.

Q. WHY SHOULD THE MILITARY PAY YOUR COMPANY SIMPLY TO PASS AN ORDER FOR SPARE PARTS THROUGH TO ONE OF YOUR VENDORS?

A. OBVIOUSLY, THERE IS A LEGITIMATE COST ASSOCIATED WITH ANY ORDER PASSED THROUGH ONE COMPANY TO ANOTHER. BUT, WHY PASS THE ORDER THROUGH THE FIRST COMPANY? WHY NOT GO DIRECT TO THE ACTUAL MANUFACTURER OF THE PART? THIS IS, OF COURSE, WHAT SHOULD BE

DONE. IN FACT, SOME COMPANIES HAVE NOW ESTABLISHED A POLICY THAT THEY WILL REJECT ANY ORDER FROM THE NAVY FOR A PART WHICH THEY DO NOT MAKE THEMSELVES. HOWEVER, IN ORDER TO GO DIRECT TO MANUFACTURERS' PARTS VENDORS, WE MUST KNOW WHO THEY ARE. MANY OF YOUR COMPANIES HAVE RECENTLY BEGUN TO PROVIDE LISTS OF VENDORS TO THE NAVY OR HAVE AGREED TO DO SO. HOWEVER, MOST OF THE LISTS RECEIVED THUS FAR, IN MY OPINION, INVOLVE A CERTAIN AMOUNT OF RISK SINCE ONLY FSCMs AND PART NUMBERS HAVE BEEN PROVIDED. THIS IS GENERALLY INADEQUATE SINCE IT PROVIDES US WITH LITTLE OR NO TECHNICAL INFORMATION ON THE PART AND DOES NOT INSURE THAT WE WILL ALWAYS BE ABLE TO BUY THE ACTUAL PART USED IN THE EQUIPMENT UNDER THAT PART NUMBER. MY CONCERNS SEEM TO HAVE BEEN HEEDED BY THE SUPPLY SYSTEM. SUCH LISTS BY THEMSELVES WILL NO LONGER BE SOLICITED. IN THE FUTURE, SPCC INTENDS TO ASK FOR AT LEAST THE MINIMUM TECHNICAL DOCUMENTATION AN EQUIPMENT MANUFACTURER WOULD INVOKE IN HIS PURCHASE ORDER. THIS IS AN AREA WHERE WE NEED INCREASED COOPERATION IN THE FUTURE.

THUS FAR, I HAVE CHASTIZED INDUSTRY FOR THE GENERAL INADEQUACY OF TECHNICAL DOCUMENTATION FOR COMPETITIVE PROCUREMENT OF SPARE PARTS. BUT, THE NAVY AND THE OTHER SERVICES EACH SHARE IN THE

CAUSES OF THIS INADEQUACY. IN MANY CASES, WE HAVE FAILED TO ADEQUATELY SPECIFY TECHNICAL DOCUMENTATION REQUIREMENTS IN ACQUISITION CONTRACTS, OR WE HAVE FAILED TO INSURE THAT CONTRACTORS FULLY MET ALL DOCUMENTATION REQUIREMENTS. IN MY OPINION MANY OF THE MIL-STANDARDS AND MIL-SPECS ARE UNCLEAR IN THEIR REQUIREMENTS AND IN SOME CASES ARE DOWN RIGHT AMBIGUOUS. MANY OF OUR CONTRACTS LEAVE A LOT TO BE DESIRED AS FAR AS CLARITY AND SIMPLICITY ARE CONCERNED. IF THE MILITARY SERVICES REALLY ARE SERIOUS ABOUT WANTING TECHNICAL DOCUMENTATION WHICH IS FULLY ADEQUATE FOR UNLIMITED COMPETITION, THEN WE HAVE A LOT TO DO TO CLEAN UP OUR ACT.

WHAT ABOUT THE FUTURE? HOW IS THIS DILEMMA GOING TO BE RESOLVED? IN MY OPINION, REAL AND LASTING SOLUTIONS WILL TEST THE FLEXIBILITY OF BOTH THE MILITARY AND INDUSTRY AS MANY OF THE REQUIRED ACTIONS WILL NOT ONLY NECESSITATE INDEPENDENT ACTION BY EACH BUT MANY ACTIONS WILL ALSO REQUIRE CLOSE COOPERATION AND COORDINATION BETWEEN THE MILITARY AND INDUSTRY. IMPROVED COOPERATION AND COORDINATION BETWEEN THE MILITARY AND INDUSTRY ARE, IN FACT, THE KEYS TO THE FUTURE. HOWEVER, WE MUST BE CAREFUL THAT SUCH IS NOT VIEWED AS "COLLUSION WITHIN THE MILITARY-INDUSTRIAL COMPLEX."

LAST OCTOBER I HAD THE OPPORTUNITY TO CHAIR A PANEL ON "REDUCING THE COST OF SPARE PARTS" AT THE DOD STANDARDIZATION CONFERENCE AT LEESBURG, VA. I WAS FORTUNATE TO HAVE HAD SOME VERY SENIOR REPRESENTATIVES OF INDUSTRY AS WELL AS REPRESENTATIVES, BOTH UNIFORMED AND CIVILIAN, OF THE MILITARY ON MY PANEL. I THOUGHT WE HAD SOME VERY GOOD PRESENTATIONS AND SOME LIVELY DISCUSSIONS. WE MADE A NUMBER OF RECOMMENDATIONS, ALL OF WHICH WERE ACCEPTED AS CONFERENCE ACTION ITEMS IN THE FINAL REPORT. MOST OF THESE ARE AT THE DOD LEVEL FOR ACTION. I MENTION THIS BECAUSE MANY OF THOSE RECOMMENDATIONS, NOW ACTION ITEMS, DEAL WITH GREATER INTERACTION BETWEEN THE MILITARY AND INDUSTRY IN GENERAL, AND SPECIFICALLY WITH THE ESTABLISHMENT OF SOME AD HOC DOD/INDUSTRY STUDY GROUPS TO ADDRESS TECHNICAL DOCUMENTATION REQUIREMENTS AND PROCUREMENT PRACTICES. THE ADPA TECHNICAL DOCUMENTATION DIVISION NEEDS TO SUBTLY USE WHATEVER INFLUENCE YOU MAY HAVE TO KEEP THESE ITEMS ALIVE AND WORKING.

WE NEED TO ALSO COLLECTIVELY LOOK AT COSTS OF TECHNICAL DOCUMENTATION AND INSURE THAT EFFORTS ARE TAKEN TO REDUCE THOSE COSTS TO THE MINIMUM. TOGETHER WE MUST MAKE SURE THAT THE TECHNICAL DOCUMENTATION THAT THE MILITARY BUYS, WHATEVER THE REASON, BE IT DESIGN, MAINTENANCE, OR INITIAL AND REPROCUREMENT SPARE PARTS SUPPORT, IS COMPLETELY ADEQUATE FOR THE INTENDED PURPOSE. WE MUST REVIEW TECHNICAL DOCUMENTATION REQUIREMENTS TO INSURE MINIMUM REDUNDANCY AND MAXIMUM USABILITY. WE NEED TO, AS ONE OF MY ENGINEERS IS FOND OF SAYING, "ALWAYS CALL THE SAME THING, THE SAME THING." WE NEED TO USE THE SIMPLIST NAMES FOR PARTS. WE MUST STOP CALLING A SIMPLE MECHANICAL PENCIL A "MARKING STYLUS" AND PRICING THE "STYLUS" AT $154.00 WHEN THE ITEM IS IN FACT A NAME BRAND MECHANICAL PENCIL PRICED AT ABOUT $3.00. THIS IS AN ACTUAL CASE FOR WHICH I HAVE THE EVIDENCE WITH ME. NOT ONLY THAT, BUT THE DRAWING HAS A NOTE TO DISCARD THE PLASTIC CASING. WE MUST INCREASE AWARENESS THROUGHOUT PROCUREMENT ACTIVITIES OF THE REAL TECHNICAL DOCUMENTATION REQUIREMENTS NECESSARY FOR UNLIMITED COMPETITION SO THAT THESE REQUIREMENTS CAN BE APPROPRIATELY APPLIED.

WE MUST APPRAISE THOSE IN SENIOR POSITIONS THAT IT MAY AT TIMES COST MORE TO OBTAIN OR DEVELOP REQUIRED TECHNICAL DOCUMENTATION THAN WE MIGHT EXPECT TO SAVE THROUGH COMPETITION. WE MUST RESIST THE PRESSURES TO COMPETE AT ANY COST. COMPETITION MUST PRESENT A POTENTIAL FOR SIGNIFICANT SAVINGS WHEN ALL DOCUMENTATION COSTS ARE CONSIDERED OR ELSE, IN MY OPINION, IT IS NOT A VIABLE PROCUREMENT ALTERNATIVE. ALTHOUGH I AM A STRONG SUPPORTER OF INCREASED COMPETITION, WE MUST NOT LET THOSE WHO ADVOCATE "COMPETITION AT ANY COSTS" WIN OUT OVER THOSE WHO SUPPORT "TECHNICAL COMPETENT COMPETITION." A CASE CAME TO MY ATTENTION RECENTLY WHERE AN EQUIPMENT MANUFACTURER, WHO HAD MADE A PARTICULAR PART IN HIS SHOP AND HAD BEEN THE SOLE SOURCE FOR THAT PART, WAS PROHIBITED FROM BIDDING ON A SOLICITATION BECAUSE IT WAS SET ASIDE FOR SMALL BUSINESS. TO TOP IT OFF, THE PRIME'S PART WAS PROVIDED AS A SAMPLE. THIS, TO ME, IS LUDICROUS!

BUT, WE MUST FACE FACTS. THE PRESSURES TO COMPETE SPARE PARTS ARE NOT GOING TO GO AWAY. ON THE CONTRARY, I EXPECT THAT THE SCREWS WILL BE TIGHTENED EVEN MORE BY CONGRESS AND DOD NEXT YEAR AND THE HEAT WILL FURTHER INCREASE. IN ALL OF OUR ACTIONS

IN THE FUTURE, WE MUST INSURE THAT THE REQUIREMENTS FOR TECHNICAL DOCUMENTATION ARE CLEAR, CONCISE AND REALISTIC. WE MUST AVOID REDUNDANCY AND DUPLICATION. ABOVE ALL, OUR ACTIONS, BOTH MILITARY AND INDUSTRY, INDIVIDUALLY AS WELL AS COLLECTIVELY, MUST BE CREDIBLE AND ABOVE REPROACH. OUR REPUTATIONS ARE ON THE LINE.

IN CLOSING, I WOULD TELL YOU THAT AS A SIMPLE "SHIP DRIVER" MY BOTTOM LINE ALWAYS IS IMPROVED SUPPORT FOR THE FLEET. WE FACE SOME SIGNIFICANT CHALLENGES AS FAR AS RESOLVING THE ISSUES RELATING TO THE PRESENT SITUATION WHERE MUCH TECHNICAL DOCUMENTATION IS NOT ADEQUATE FOR FULLY COMPETITIVE PROCUREMENT OF SPARE PARTS. BUT THERE REALLY HAVEN'T BEEN MANY CHALLENGES THAT THE MILITARY AND INDUSTRY HAVEN'T BEEN ABLE TO SOLVE WHEN WE WORK TOGETHER TOWARD A COMMON OBJECTIVE. THE OBJECTIVES HERE ARE COMMON BECAUSE OF THE ULTIMATE IMPACT ON BOTH PARTIES, THE MILITARY AND INDUSTRY. WE HAVE BOTH TAKEN ENOUGH HITS AND BEEN GIVEN ENOUGH BLACK EYES BY THE MEDIA ON THE LACK OF COMPETITION FOR SPARE PARTS. THE DRIVE FOR INCREASED COMPETITION IS HERE TO STAY--AND WELL IT SHOULD. TO FILL OUR RESPECTIVE AND

COLLECTIVE RESPONSIBILITIES, WE NEED TO GET ON WITH IMPROVING THE SYSTEM SO THAT MY BOTTOM LINE OF IMPROVED SUPPORT TO THE FLEET CAN BE ACHIEVED.

DEPARTMENT OF DEFENSE
TECHNICAL MANUAL SPECIFICATIONS AND STANDARDS (TMSS) PROGRAM

by

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SUMMARY

This paper provides an overall status report on the TMSS Program related to eleven Joint Service Tasks described in the TMSS Program Plan dated July 1983. Primary emphasis is on the status of Task 1 and Task 4 ; Task 1 being the highest priority task designed to develop a single set of DOD Requirements documents for the writing of operator and maintenance equipment manuals.

INTRODUCTION - Technical Manual Specifications and Standards (TMSS) is a Department of Defense (DOD) Standardization Program. Policies, procedures and instructions pertinent to TMSS are contained in the Defense Standardization Manual, DOD 4120.3-M.

PROBLEM - (Figure 1) The issue simply put is why do we need individual service specifications for preparation of technical manuals. Whether we are developing individual service manuals or joint use manuals, it is not reasonable to have differing specification to cover the content and format of these publications. Under current policy, costs can be driven up when services insist on their peculiar requirements on joint use manuals. For systems like TRI-TAC, we have been patch working together, through time consuming negotiations, specifications that could result in poor service to the user. There should be no overriding reason why a single set of DOD specifications for TM's/TO's and parts manuals cannot be developed. We currently list almost 200 specifications used to develop TM's/TO's with very few of these being joint service specifications.

(Figure 2) In a Time cover story dated 7 Mar 83, related to high weapons costs within DOD, There was a highlighted boxed section pertaining to military specs. It talked about the number of specs related to T-shirts, chewing gum, and food sauce. The story could very well have listed our TM specs.

PROGRAM PLAN - (Figure 3) However, we do have an on-going program designed to overcome the problem and to consolidate the individual service documents into Joint Use DOD Specifications approved by all services and OSD. The current plan was approved and published in July 1983 and includes 11 Joint Service Tasks. This Program Plan is a complete revision of the preceding plan dated January 1980.

WORKING GROUP - (Figure 4) To effectively implement the TMSS Program Plan and cope with the complex job of developing single sets of DOD requirements documents, a TMSS Work Group was formed. This work group consists of personnel from every service who are extremely knowledgeable in the Technical Manuals Field. The group was formed in 1980 and has met on a frequent, periodic basis since that time. Continuity of representation has been an essential factor in the effectiveness of the group.

JOINT SERVICE TASKS - (Figure 5) The 11 Joint Service Tasks are depicted in this chart with summary titles. The task with the highest potential payoff, and thus priority one, is Task 1 in which we have already started work to develop a single set of specifications and DID's for the preparation of operator and organizational and intermediate maintenance manuals. Tasks 3 and 4 are the responsibility of NMC and Tasks 6 and 10 will be the responsibilty of AFLC.

STATUS - TASK 1 - (Figure 6) Task 1 is the keystone to the whole joint service effort and has the highest potential payoff. The work group has identified 40 specifications that are currently used to develop operator manuals and organization and intermediate manuals. These 40 cover documents from each service. We used a contractor to supply us with labor intensive effort to identify and document the common and service peculiar requirements into technical data packages. We met as a work group with the contractor on periodic in-process reviews to mutually agree on what constituted a common or peculiar requirement.

(Figure 7) We have observed that when you analyze our service specs, it is apparent how close we are in our approaches and intent. There are very many common requirements among the various documents and of course some service peculiar requirements. But we are so close in goals that we are most optimistic we can design single DOD documents.

(Figure 8) The current status of Task 1 is that we've identified and agreed to all operator manual and maintenance manual (except depot) common and peculiar requirements from the 40 specs. We've also agreed to a selection of common and the best of the peculiar requirements for inclusion in the final DOD documents. The first draft document on operator manuals and IPB's is out for final work group concurrence. The organization and intermediate maintenance manual documents are being drafted right now. All documents are to be coordinated during this CY 84. The final documents are milestoned for completion early in CY 85. Phase 2 to this task will be to determine the feasibility of coming up with a single DOD document for depot maintenance.

STATUS - TASK 4 - (Figure 9) Task 4, assigned to Navy as the lead for implementation, was designed to investigate the development, implementation, and impact of electronic (digital) delivery of technical information to the services operators and maintainers as a substitute or supplement to hard copy TM's/TO's. The first phase was to determine the extent of proliferation of different hardware and software systems planned or being introduced into use by the services; assess the need for management control in the introduction of the technology and for specifications and standards for the hardware and software systems involved. Figure 9 summarizes the problems resulting from lack of standardization of electronic TI as reported by Navy.

(Figure 10) A partial list of automated or electronic display systems is shown on Figure 10. These include systems designed to automate TM production, to deliver technical information electronically and include both hardware and software in stages ranging from conceptual to operational. The proliferation is extensive.

(Figure 11) The first phase of Task 4 has been completed as shown in Figure 11. The need for management control is obvious and the need for specs and standards for the hardware, software and displays is also obvious. The next phase is for the working group to recommend the TMSS role and the steps to be taken to effect standardization.

SUMMARY - (Figure 12) At the working level and at the four star level (as evidenced by JLC approval of the TMSS Program Plan) there is agreement that we can achieve singular sets of DOD specs/Stds. The progress to date has been excellent due in large part to the successful operation of the TMSS Work Group. Most of the joint service tasks will depend on the successful outcome of Task 1. Successful completion of Task 1 will have a significant impact on the eventual outcome of Task 4. The opportunity to effect standardization in Task 4 is now, before the rabbits multiply beyond control.

PROBLEM

VARIOUS FORMATS DRIVE UP COSTS

PATCHWORK COMPROMISES ILL-SUIT USER

ALMOST 200 SPEC's FOR TM's/TO's

VERY FEW JOINT SERVICE SPECS

Figure 1

COVER STORY

TIME MAGAZINE
MARCH 7, 1983

"THE WINDS OF REFORM--
RUNAWAY WEAPONS COSTS PROMPT A NEW LOOK
AT MILITARY PLANNING"

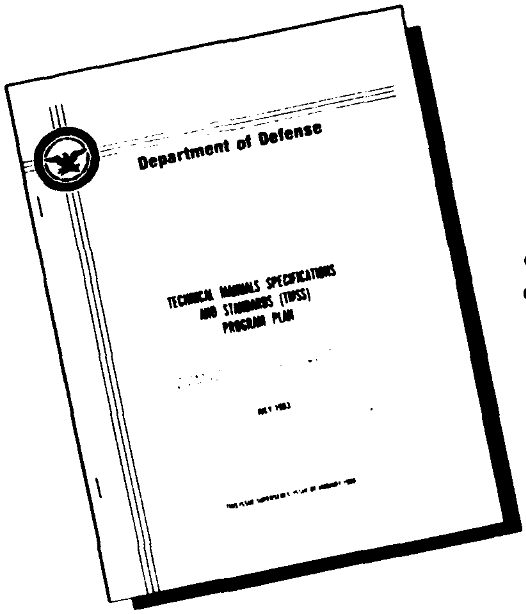
EXCERPT----

"TWENTY FOUR PAGES ARE REQUIRED TO LIST
THE SPECS FOR T-SHIRTS, 15 PAGES FOR CHEWING
GUM, AND 17 FOR WORCESTERSHIRE SAUCE."

Figure 2

DOD TECHNICAL MANUALS SPECIFICATIONS AND STANDARDS (TMSS)

- ARMY IS LEAD SERVICE
- MRSA IS LEAD SERVICE ACTIVITY
- MRSA COORDINATES AND PUBLISHES DOD TMSS PROGRAM PLAN



TMSS PROGRAM PLAN

- DOCUMENTS JOINT SERVICE TASKS
- DOCUMENTS INDIVIDUAL SERVICE TASKS

Figure 3

TMSS WORK GROUP

- US ARMY DARCOM MATERIEL READINESS SUPPORT ACTIVITY (LEAD SERVICE)
- HQ AIR FORCE LOGISTICS COMMAND
- HQ AIR FORCE SYSTEMS COMMAND
- NAVAL SEA SYSTEMS COMMAND
- NAVAL AIR TECH SVCS FACILITY
- NAVAL ORDNANCE STATION
- HQ MARINE CORPS

NOTE: ADDITIONAL ON-CALL PARTICIPATION FROM ANY SOURCE AS NEED ARISES

Figure 4

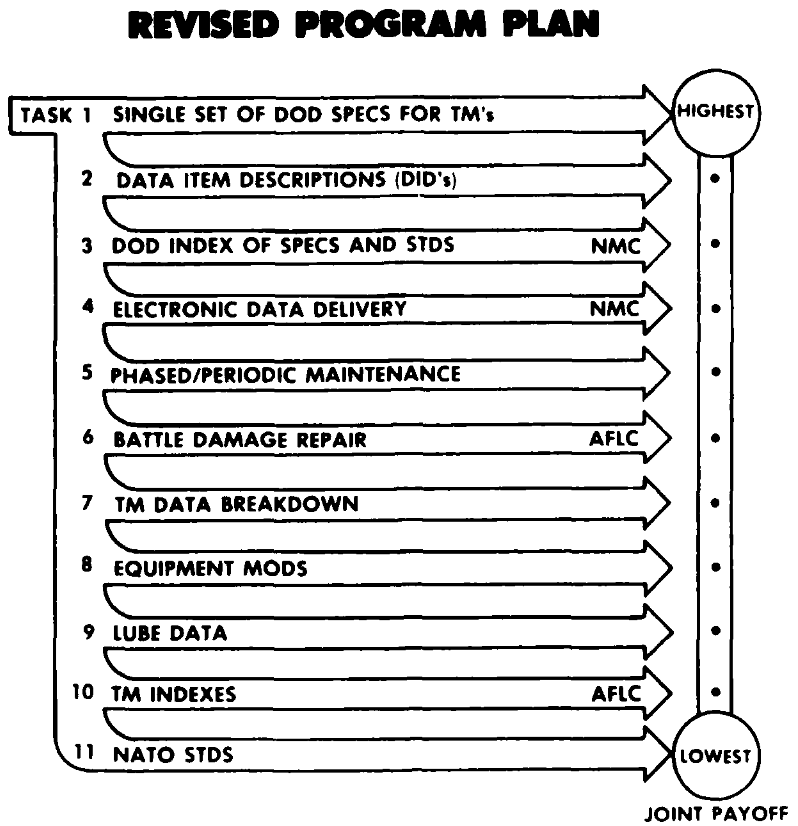


Figure 6

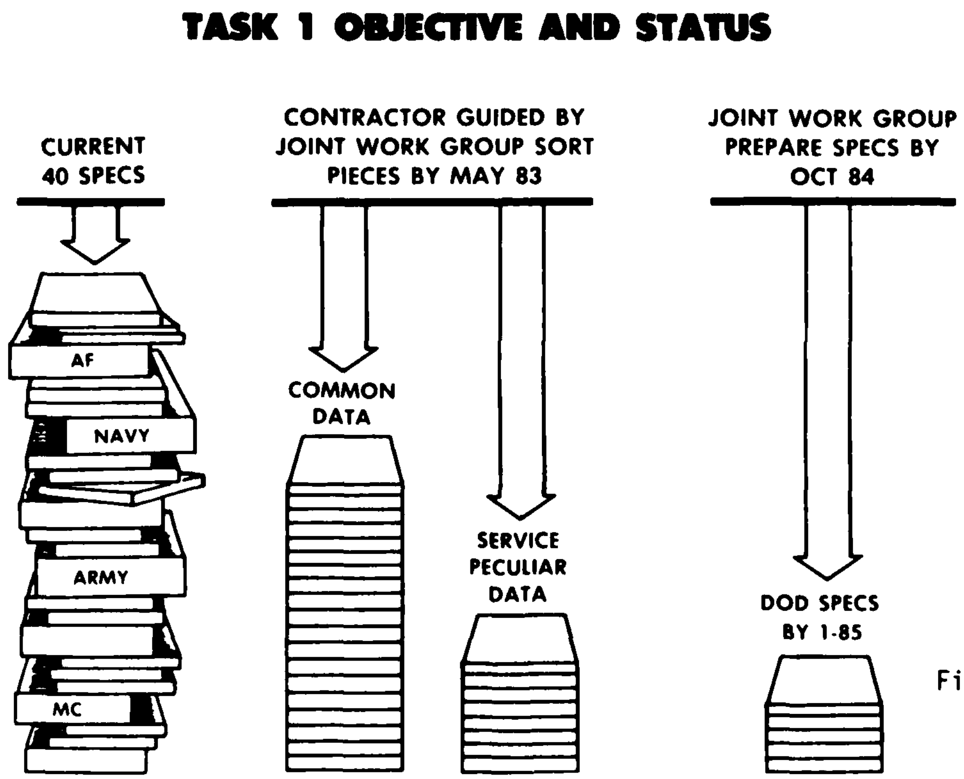


Figure 5

OBSERVATIONS

INNOVATIONS OF EACH SERVICE SIMILAR

LESS TEXT

MORE ILLUSTRATIONS

WRITTEN TO TARGET AUDIENCE

MANY COMMON REQUIREMENTS

SOME SERVICE PECULIAR REQUIREMENTS

Figure 7

TASK 1

- ALL OPERATOR MANUAL AND MAINTENANCE MANUAL COMMON AND PECULIAR REQUIREMENTS FROM THE 40 SPECS HAVE BEEN IDENTIFIED AND AGREED TO BY THE WORKING GROUP
- THE SELECTION OF COMMON AND PECULIAR REQUIREMENTS HAS BEEN DETERMINED FOR INCLUSION IN THE FINAL DOD DOCUMENTS AND DRAFT SPECS ARE BEING WRITTEN
- THE FIRST DRAFT SPEC ON OPERATOR MANUALS AND IPB's IS OUT FOR FINAL WORK GROUP CONCURRENCE
- PLANS ARE TO COORDINATE ALL DRAFTS IN THIS CY 84
- TARGET DATE FOR FINAL SPEC PRINTING -- EARLY CY 85

Figure 8

TASK 4

PROBLEMS RESULTING FROM LACK OF STANDARDIZATION OF ELECTRONIC TI

- INTRODUCTION OF SYSTEMS UNFIT FOR USE IN MILITARY ENVIRONMENTS
- ILS RENDERED IMPOSSIBLE DUE TO UNCONTROLLED PROCUREMENT OF MANY NON-STANDARD EQUIPMENTS
- INFLATED COSTS NOT ONLY FOR INITIAL BUYS BUT FOR LIFE CYCLE MAINTENANCE
- CONTROL AND CONFIGURATION MANAGEMENT IN UNCONTROLLED PROCUREMENT OF ELECTRONIC TI DISPLAY SYSTEMS WOULD BE INSUPPORTABLE
- INCOMPATIBILITY OF EQUIPMENT

Figure 9

TASK 4

PARTIAL LIST OF AUTOMATED OR ELECTRONIC DISPLAY SYSTEMS (CONCEPTUAL TO OPERATIONAL)

ADDS	MEIDS
APPS	MIDAS
ATOS	MM
AXXA	MOUNT
CAMIS	NAVIS
CEDARS	NOMAD
CMAS	NTIPS
EEMT	PEAM
EIDS	PIXEY
EMSASS	SCC
FACT	STARS
FIND	TICCIT
GRID	TIMS
HUSKY	TMIS
LOGMOD	VIABLE
LEIDS	VISTA
MAFI	ZOG

Figure 10

TASK 4

- ASSESSMENT HAS BEEN MADE OF THE DEVELOPMENT, IMPLEMENTATION AND IMPACT OF ELECTRONIC DELIVERY OF TECHNICAL INFORMATION TO THE SERVICES OPERATORS AND MAINTAINERS
- THE CURRENT EXTENT OF PROLIFERATION OF DIFFERENT HARDWARE AND SOFTWARE SYSTEMS PLANNED OR BEING INTRODUCED HAS BEEN ASSESSED
- THE NEED FOR MANAGEMENT CONTROL IS OBVIOUS. THE NEED FOR SPECIFICATIONS AND STANDARDS FOR THE HARDWARE, SOFTWARE AND DISPLAYS IS ALSO OBVIOUS
- THE NEXT PHASE IN TMSS TASK 4 IS FOR THE WORKING GROUP TO RECOMMEND THE TMSS ROLE AND THE STEPS TO BE TAKEN TO EFFECT STANDARDIZATION

Figure 11

SUMMARY

- WITHIN THE TM COMMUNITY, SERVICES AGREE WE CAN ACHIEVE SINGULAR SETS OF DOD SPECS/STDS
- PROGRESS TO ACHIEVE DOD DOCUMENTS HAS BEEN EXCELLENT
- MOST OF THE TMSS JOINT SERVICE TASKS WILL DEPEND ON OUTCOME OF TASK 1
- SUCCESSFUL COMPLETION OF TASK 1 WILL BE OF SIGNIFICANT IMPORTANCE TO OUTCOME OF TASK 4
- THE OPPORTUNITY TO EFFECT STANDARDIZATION IN TASK 4 IS NOW

Figure 12

NEW DIMENSIONS IN INFORMATION STORAGE AND RETRIEVAL

Joseph M. Connelly

<u>MNEMOS</u>
Federal Region Manager

mnemos

A NEW DIMENSION IN INFORMATION STORAGE & RETRIEVAL

Image Processing and Optical Disk Technology

mnemos

MANAGEMENT PHILOSOPHY

- Provide Customer the Most Cost-Effective Solution to His Information Dissemination Problem
  - Document Design
  - Custom Application Software
  - Custom Blend of Digital Data, Graphics, and Text
  - Standalone Workstation
  - Workstation as Part of a Total System

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mnemos

PRODUCT CONCEPT

Mnemos System 6000 is:

- An Innovative Integration of Various Process Technologies...
  - Electron Beam Recording (EBR)
  - Laser Carrier Grading (LCG)
  - Optics
  - Electronics
- ...Which Merge Digital Information (Text, Data, Applications Software) with High Resolution Graphics (Micro Miniature Images) on the Same High Density Storage Media...
- ...To Economically Address a Significant and Emerging Market for Large Scale Information Dissemination, Storage & Retrieval, and Manipulation.

mnemos

PRODUCT CONCEPT (CONT'D)

Mnemos System 6000 Features and Characters:

- Mnemodisc™:
  - High Capacity/High Resolution Graphics and Text Storage
  - Various Mixtures of Image and Digital Data
  - Document Storage of Various Sizes in Vertical or Horizontal Format
  - Digital and/or Optical Indexing
  - Archival Quality

mnemos

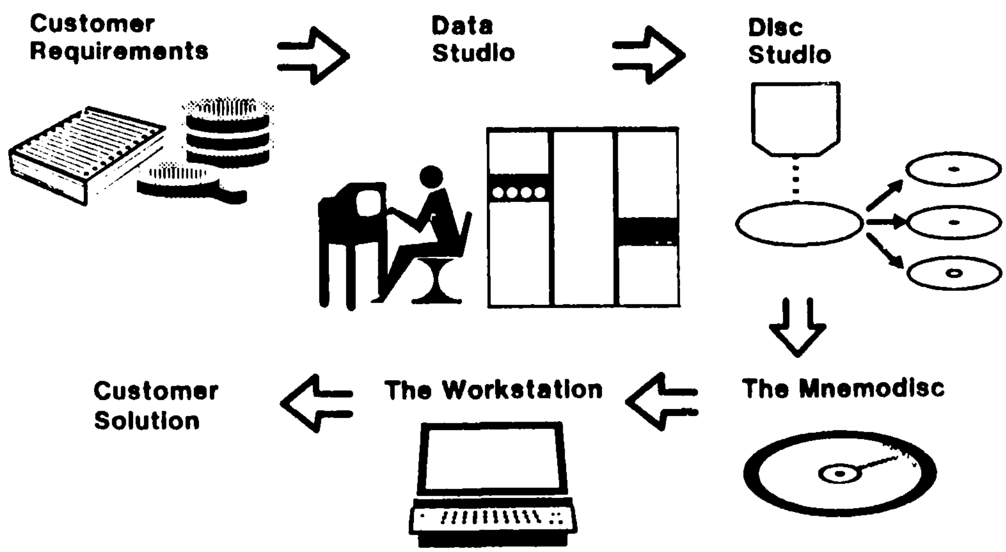
PRODUCT CONCEPT (CONT'D)

Mnemos System 6000 Features and Characters:

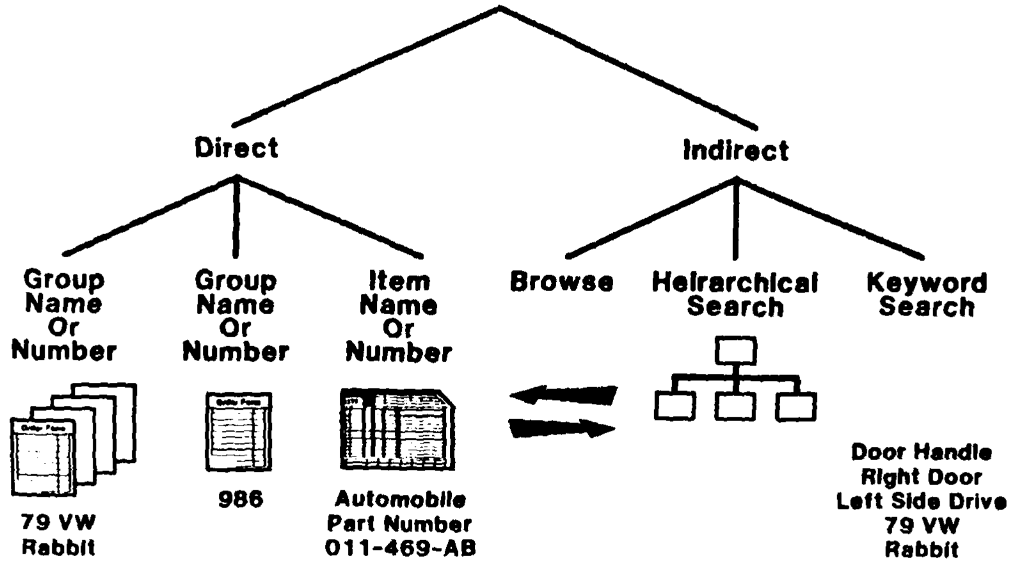
- Mnemos Workstation:
  - Rear Projection Display Module
  - Microprocessor/Memory/Controls
  - Rapid Search & Retrieval
  - Optional Communications Ports
- Intelligent Keyboard
  - Independent Microprocessor Memory
  - Digital Line Display
  - Typewriter-Like Keyboard
  - Fixed Function Keys
  - "Soft" Function Keys
  - User Programmable Functions

mnemos

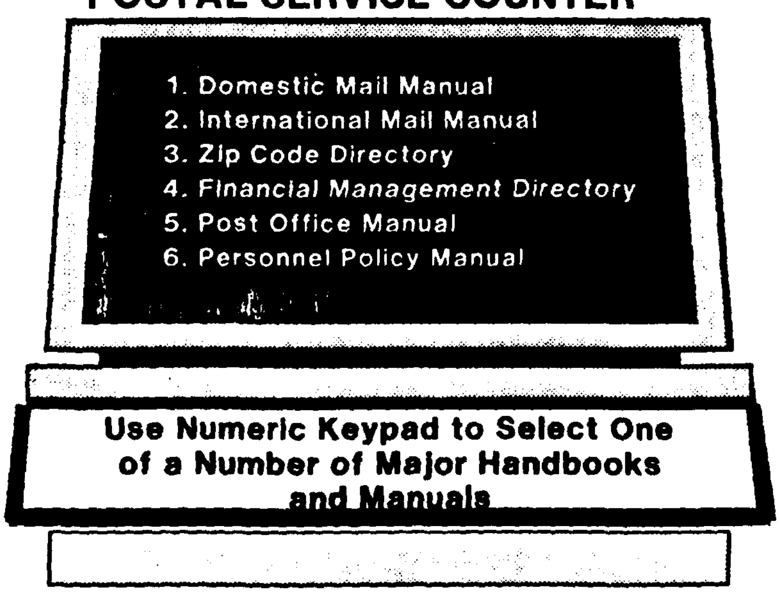
ELEMENTS OF THE SYSTEM



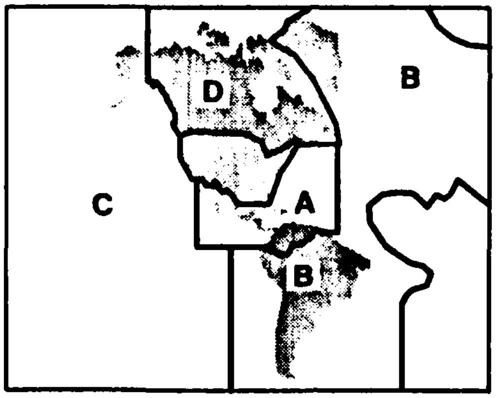
ALLOWABLE INDEXING SCHEMES



EXAMPLE APPLICATION - POSTAL SERVICE COUNTER



INTERNATIONAL MAIL MANUAL



Use Map for Easy Reference
or
Type in First Three Letters
Of Country's Name -
"BAH"AMAS

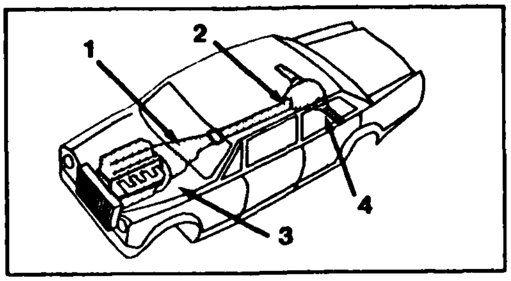
TABLES OF POSTAL RATES TO THE BAHAMAS

Weight Not Over	Rate	Weight Not Over	Rate
2 lbs.		12	13.10
3	$3.10	13	14.10
4	4.10	14	15.10
5	5.10	15	16.10
6	6.10	16	17.10
7	7.10	17	18.10
8	8.10	18	19.10
9	9.10	19	20.10
10	10.10	20	21.10
11	11.10	21	22.10
		22	23.10

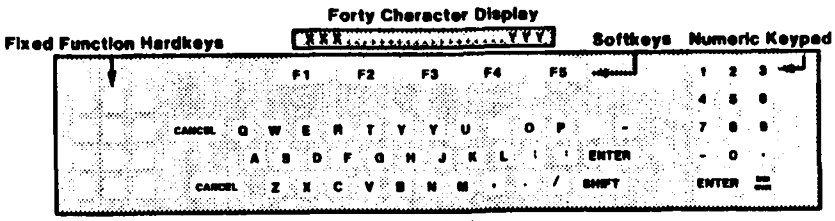
- **Pictoral Display of Rates and Rate Categories**
- **Simultaneous Down Loading of Corresponding Digital Information**
- **Enter Weight of Parcel Via Numeric Keypad**

  O O O - OR - O O O O O O O

  Automatic from Scale Via RS - 232 Interface
- **Automatic Calculation of Total Postage, Etc.**
- **Printout on Postal Form**

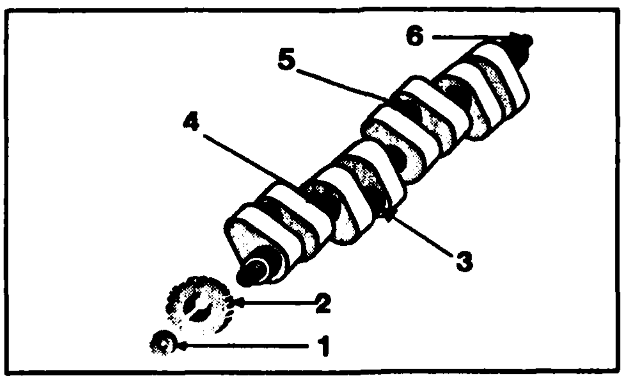


Select Functional Group With Image Keys



or

By Typing in the Functional Group and Subfunctional Code XXX

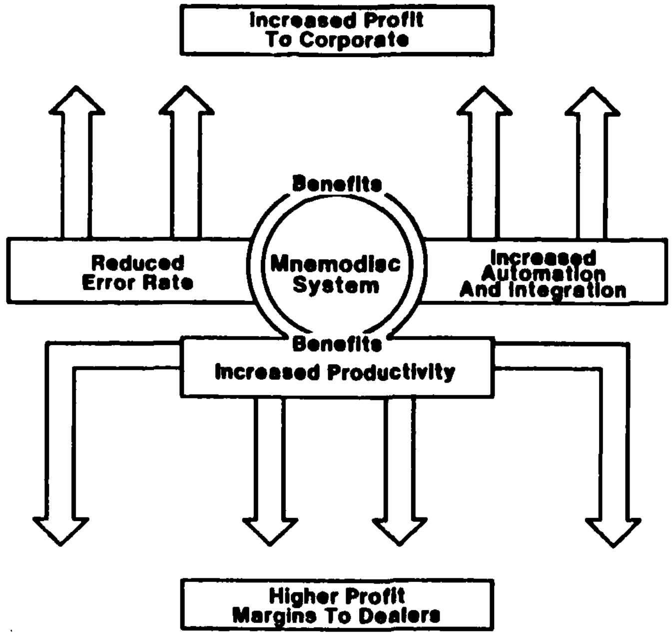


Select a Part or Subassembly with the Numeric Keypad... This Causes the Part Number to Appear in the 40 Character Display.

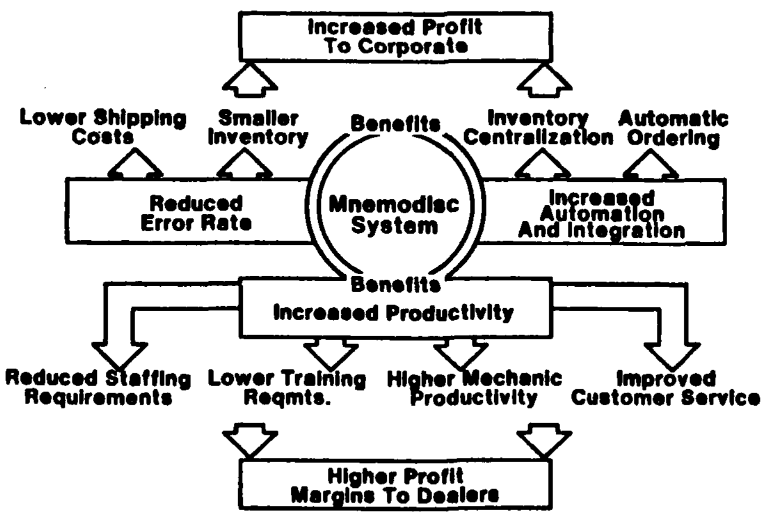
011_110_247_AA CRANKSHAFT GEAR

And the Text Page with that Number on it will Appear on the Screen

SUMMARY OF BENEFITS FROM A MNEMODISC PARTS CATALOGUE



SUMMARY OF BENEFITS FROM A MNEMODISC PARTS CATALOGUE



mnemos

PRODUCT POSITIONING
Conventional Technologies

Media	Advantages	Disadvantages
--Paper	--Familiar	--Distribution Costs --Storage Space And Cost --Difficult to Retrieve
--Micrographics	--Space Savings --Distribution Costs	--Difficult to Use --Serial --Very Limited Index

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PRODUCT POSITIONING
Alternative Technologies

Media	Advantages	Disadvantages
--Magnetic Storage (Centralized Computer Database)	--System Integration --Fast Access --Searchable Text	--Storage Costs (esp if High-Image Content) --Communication Costs
--Optical Disc	--High Storage Density of: - Text - Graphics	--High-Cost Display --High-Bit Error Rate --Communication Costs
--Video Disc	--High Storage Density of: - Color Pictures - Motion Video - Sound --Low Replica Cost	--Low Resolution (Limited by FCC Approved TV Standards)

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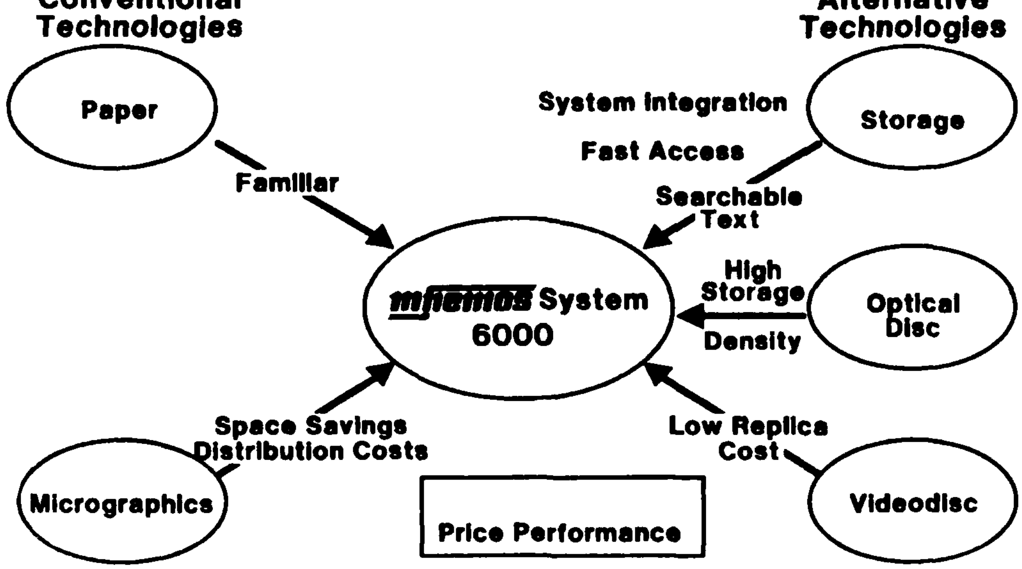
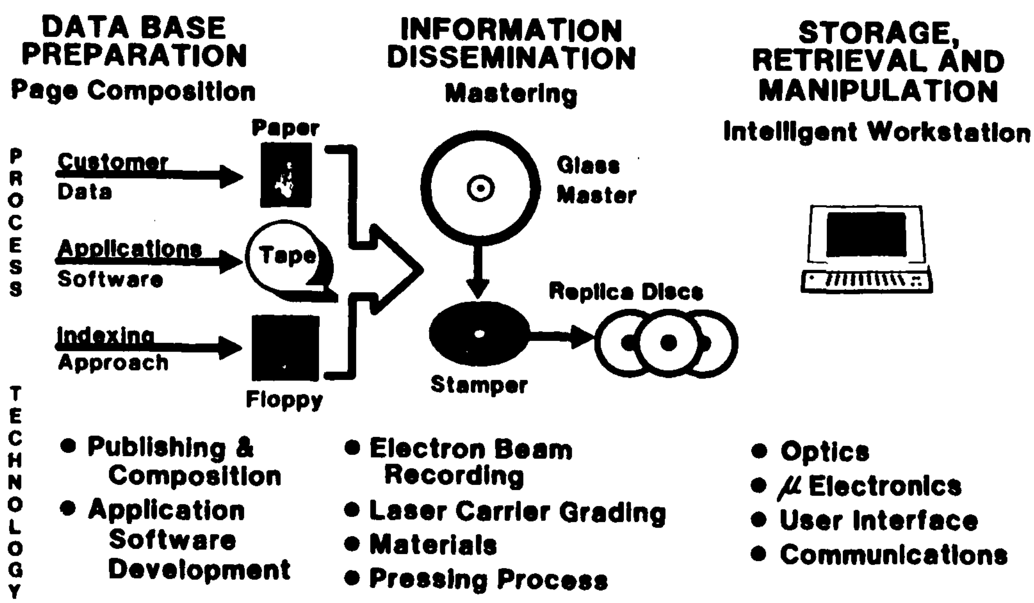
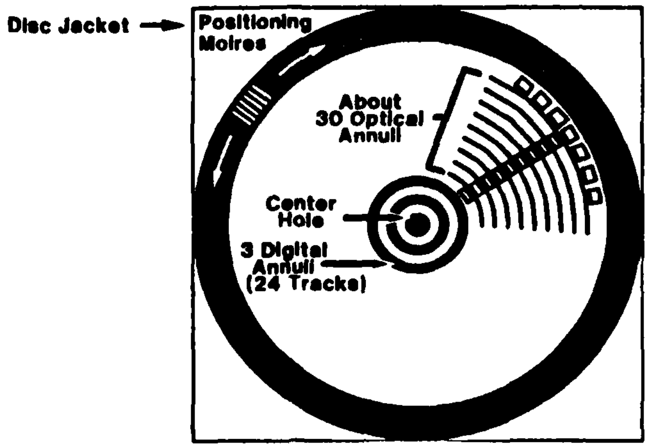
PRODUCT POSITIONING



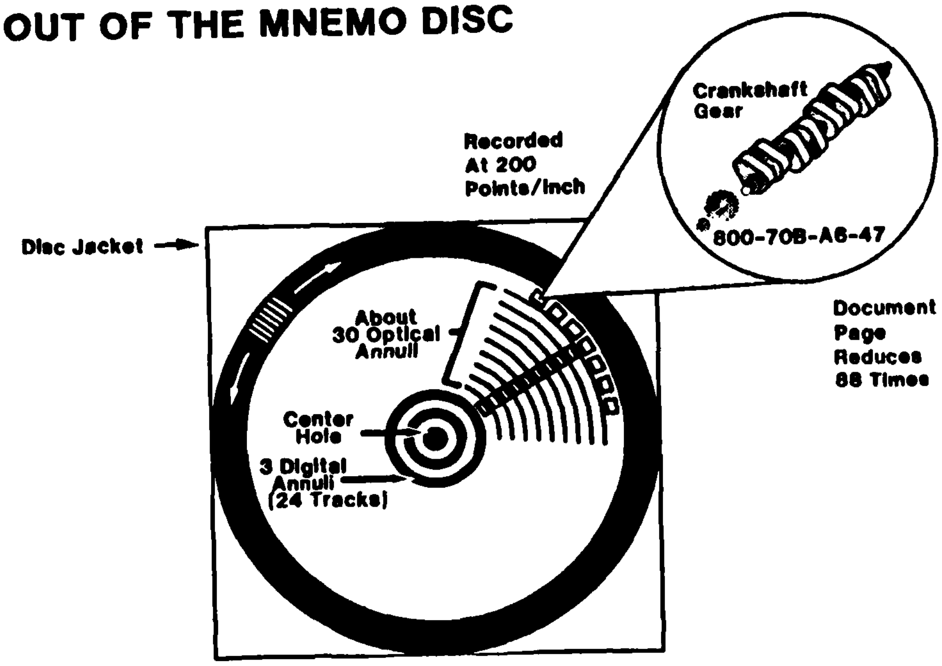
ELEMENTS OF THE TECHNOLOGY



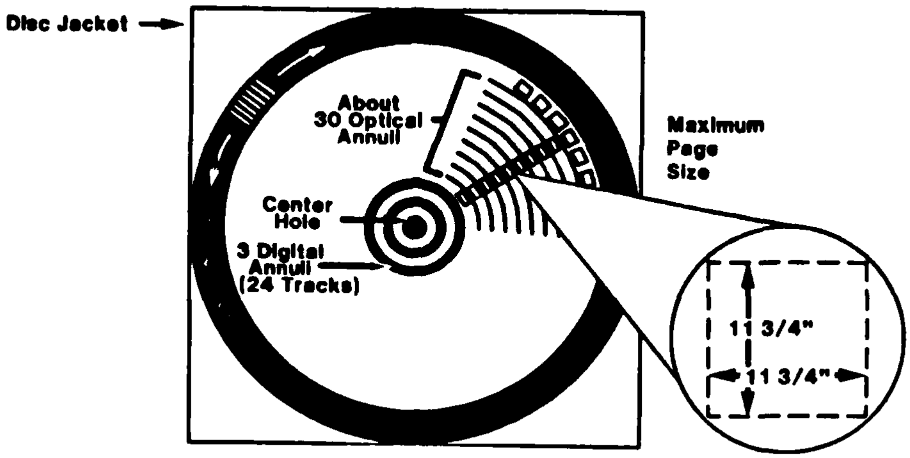
LAYOUT OF THE MNEMO DISC



LAYOUT OF THE MNEMO DISC



LAYOUT OF THE MNEMO DISC



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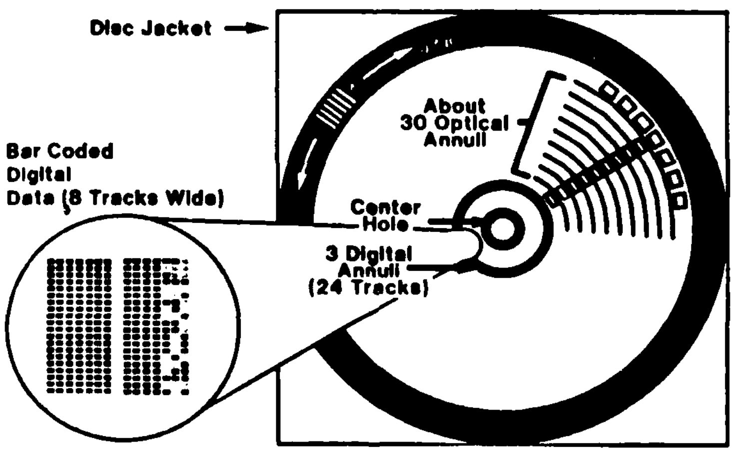
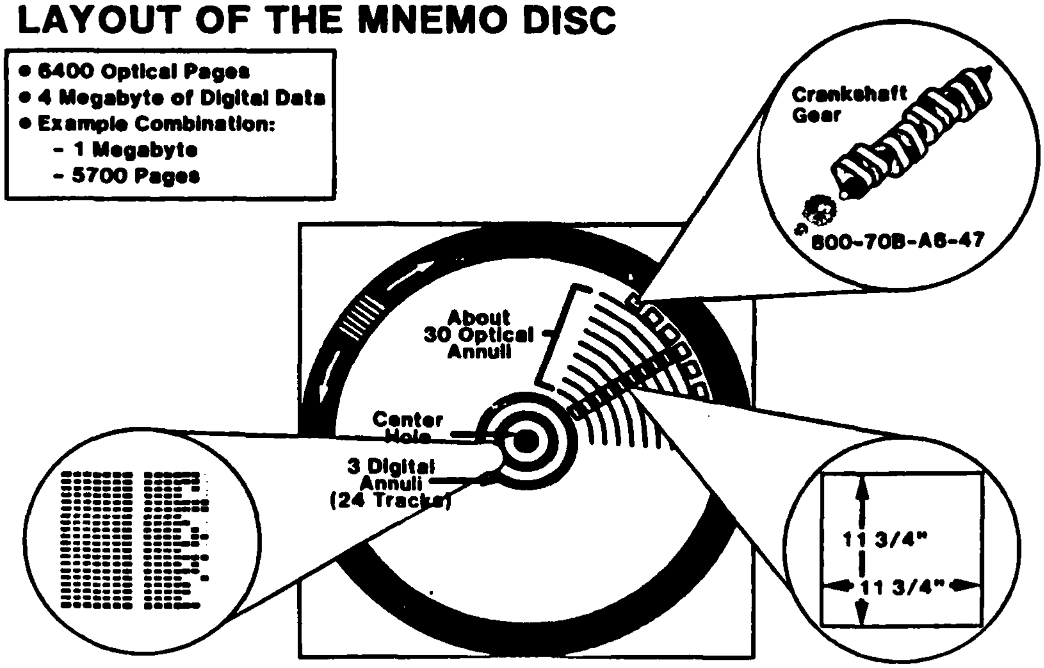
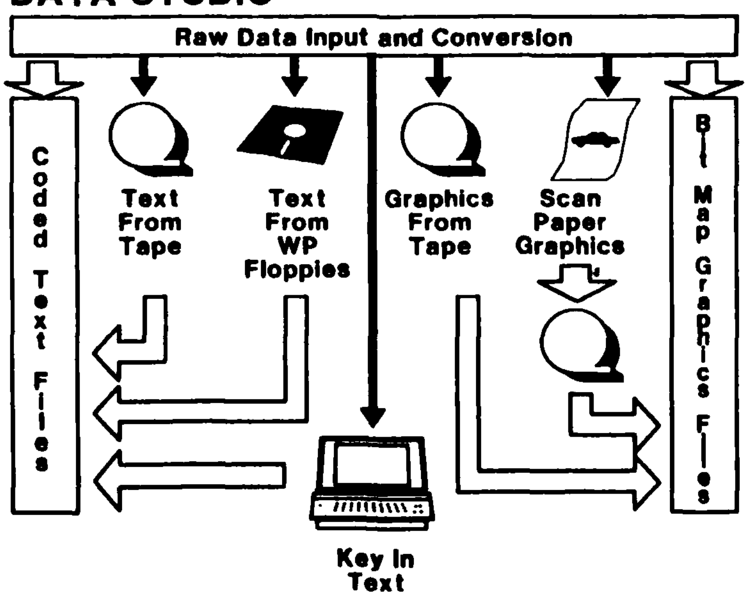


LAYOUT OF THE MNEMO DISC



DATA STUDIO



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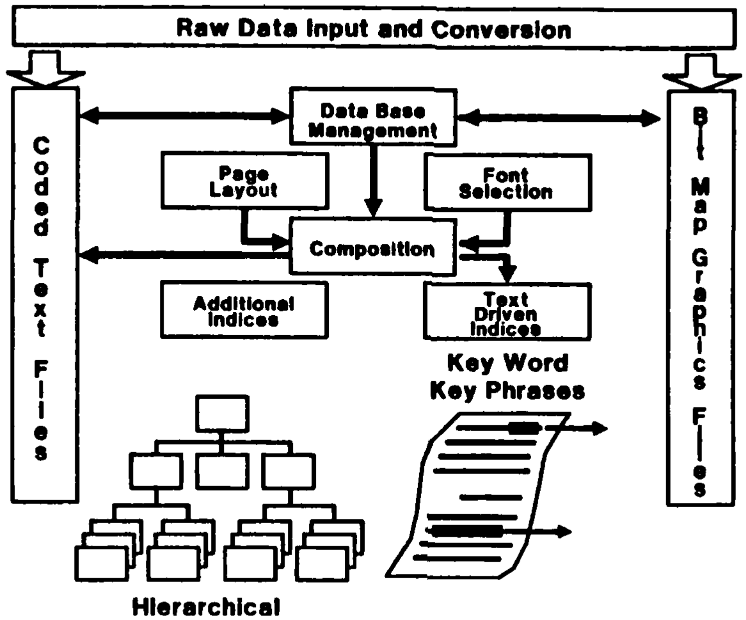
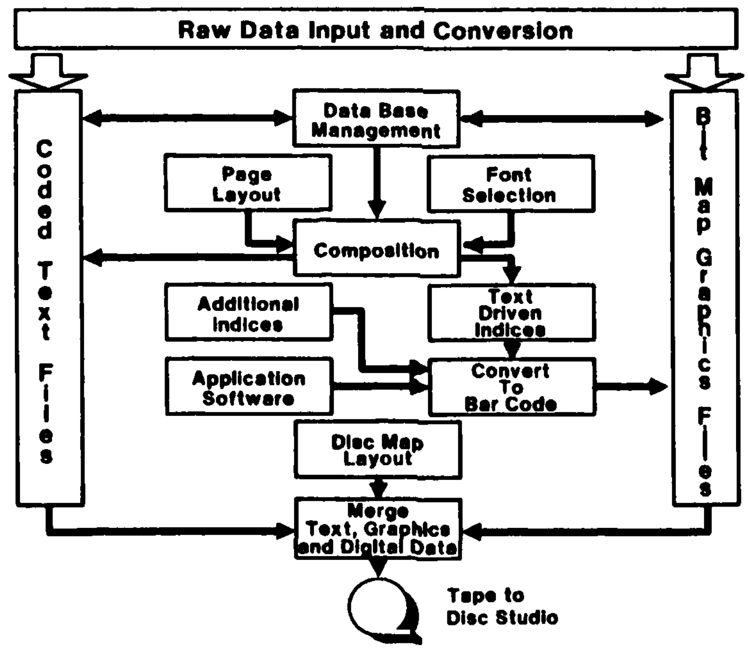
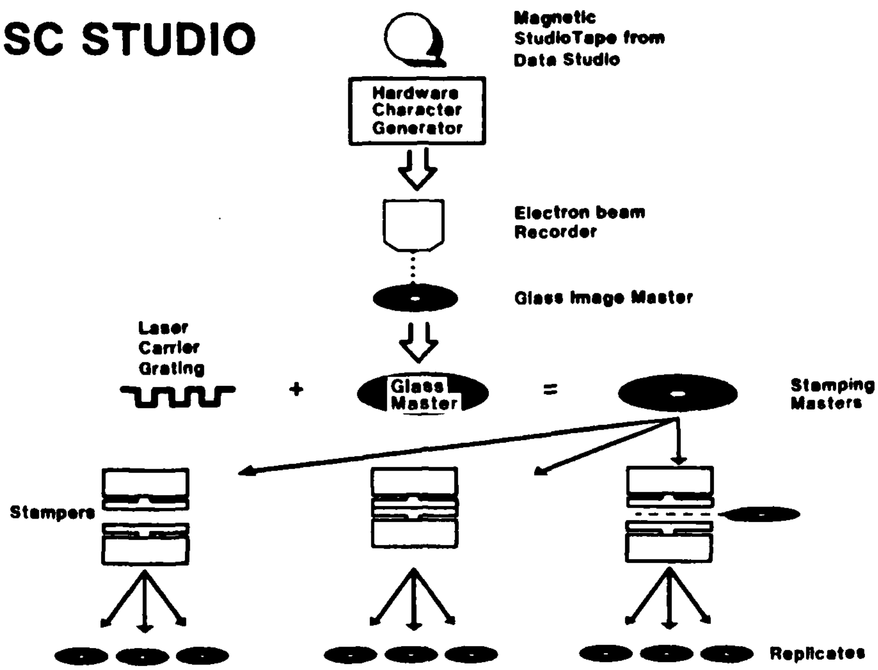


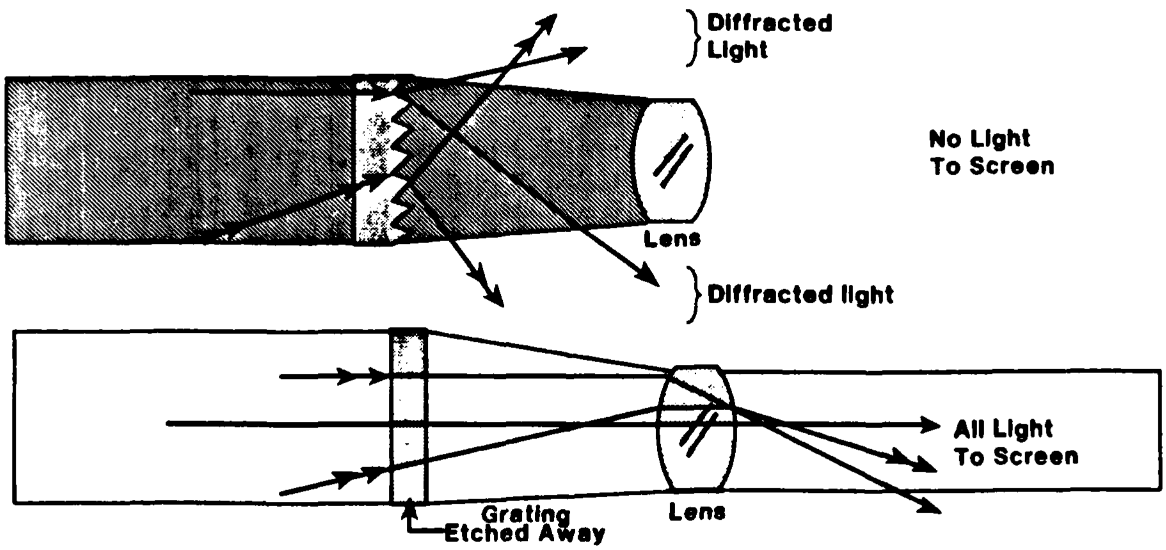
DATA STUDIO



DISC STUDIO



LASER CARRIER GRATING OPTICAL RECORDING



SESSION 4

Workshop Coordinator

MR. T. L. GOLMIS
Hughes Aircraft Company

See sections V, W, and X for Session 4 workshop summaries.

<u>SESSION 5</u>

Chairman: MR. ROBERT A. TIMLIN
Martin Marietta Corporation

Secretary: MRS. LORNA BURNS
Hughes Aircraft Company

COMPUTER-AIDED EDITING - PRESENT AND FUTURE

Dr. J. Douglas Kniffin, Westinghouse Electric Corporation

This paper describes computer-aided editing systems which analyze English text and suggest improvements. The systems described are vastly different from the familiar word processing programs which permit editing changes such as insertions and deletions of characters, words, or lines of text. These new systems analyze the style and style difficulty of text and provide feedback to writers and editors for improving readability and comprehensibility. Three systems designed originally for examining the complexity of technical documents are described. These are the Bell Laboratories Writer's Workbench, the U.S. Navy Computer Readability Editing System, and the Westinghouse Writing Aids System. Though in varying stages of development, the features of the three systems are listed and compared and the research or other basis behind the editing features is discussed. Some limited data on the use of the systems and their acceptance by users are also presented. The paper concludes with a discussion of future applications of the systems such as writing instruction, style comparison, and computer-aided translation.

1. INTRODUCTION

For thousands of years, writing and editing were unmechanized processes. The printing press and the typewriter improved the legibility of documents but were of little help in the creative writing process. To produce text that was readable, useable, grammatically correct, well organized, and suitable for the intended audience, writers and editors relied on a variety of traditional aids. These aids included personal knowledge, dictionaries, grammar books, and style guides. Advice was plentiful but often hard to follow consistently because of deadlines, drudgery, and human limitations. In this century, growth in the economy, government, and technology led to a tremendous increase in the need for documentation. The need for more documentation led to the need to automate the writing process.

Computer-based word processors began to appear in the early 1970's. The first word processors did not aid the creative writing process, but they helped to speed up the production of documentation. Once text was captured in machine-readable form, it could be manipulated in many ways. Writing and editing changes were manually marked on a word processor printout, but the changes could then be keyboarded for automatic insertion into a document. Features such as "global search and replace" made it possible to make numerous corrections in a single operation. The need for retyping a changed manuscript was eliminated, and the final version of a document could be reformatted as desired. The early word processors were a great help in document production, but more automation was needed.

By the mid 1970's, researchers began to realize that the full computational powers of word processors were not being used. For example, if a unique character string could be recognized, why not

recognize all unique character strings? In other words, why not program the word processor to check spelling? Similarly, if any ASCII character could be recognized, why not use this power to count words, sentences, and the number of characters or syllables in a word? In other words, why not program the word processor to calculate the readability grade level of text?

Programs for spelling checks and readability measurements quickly became the first automated aids to the creative writing processes. The programs were faster and generally more accurate than humans; they eliminated a great deal of boredom and drudgery. The time formerly used to check spelling could be devoted to other efforts. A readability analysis of a manuscript helped writers and editors judge its appropriateness to the intended audience. The success of spelling check and readability programs sparked interest in developing more elaborate automated aids for writers and editors.

Independently and nearly simultaneously, researchers at Bell Laboratories, the U.S. Navy's Training Analysis and Evaluation Group (TAEG), and the Integrated Logistics Support Division of Westinghouse conceived the same basic idea. Why not use the computer or word processor to automatically analyze text for compliance with clear writing principles? Automatic text analysis could provide feedback on writing style, style difficulty, vocabulary, diction, etc. Text analysis could also provide suggestions for improving the grammar, punctuation, readability, and comprehensibility of documents. Freed of many time consuming and tedious manual tasks, writers and editors could concentrate on other considerations in document design such as organization and content. With so many obvious benefits to be gained, research on automatic text analysis began in earnest.

The early research at Bell Laboratories was directed at style analysis and identifying faulty diction; TAEG concentrated first on style analysis and vocabulary control; and Westinghouse worked first on style analysis and research-proven suggestions for text improvement. The research, though not complete, has led to the development of Bell Laboratories' Writer's Workbench programs, TAEG's Computer Readability Editing System (CRES), and Westinghouse's Writing Aids System (WRITEAIDS). (Other organizations including IBM and The University of Michigan are also working on automatic text analysis.)

Section 2 of this paper will discuss the major features of the Writer's Workbench, CRES, and WRITEAIDS which have been automated or are under development. Section 3 will describe the feedback provided by the systems. Section 4 will discuss some limited data on user acceptance. Section 5 will address future applications of the systems.

2. FEATURES OF THE WRITER'S WORKBENCH, CRES, AND WRITEAIDS

The text analysis features of the Writer's Workbench, CRES, and WRITEAIDS now vary considerably even though the ultimate purpose of the systems is the same. However, as research progresses, the three systems are becoming more and more similar. The Writer's Workbench programs run under the UNIX* operating system. Originally, the CRES programs were

*UNIX is a trademark of Bell Laboratories.

written for computers or word processors with fairly large memory capacities. The CRES programs are now being rewritten for smaller stand-alone word processors. The WRITEAIDS programs were designed from the start for small stand-alone word processors.

Text analysis features tend to fall into three main categories although there is clearly some overlap in the categories. In the first category are straightforward features which are loosely defined here as customs of English language use. The second category, suggestions from writing experts, includes some "grammar rules" and clear writing principles. The third category, suggestions based on research, includes clear writing principles based on research in readability, psychology, linguistics, etc. The paragraphs which follow discuss the similarities and differences among the three systems and will discuss the rationale for the features where appropriate.

2.1 STRAIGHTFORWARD FEATURES

Table 1 summarizes the major straighforward features. Bell Laboratories has implemented all of the features in this category. TAEG and Westinghouse have not yet emphasized research in this area to any great extent.

TABLE 1. STRAIGHTFORWARD FEATURES

Feature	Writer's Workbench	CRES	WRITEAIDS
1. Spelling Check	Internally Developed	Limited to Master Word List	Commercial software
2. Punctuation Check	X	Not planned	Not planned
3. Double Word Check	X	Not planned	Not planned
4. Sexual Bias	About 170 words and phrases mechanized	Planned for Mil-Spec compliance	About 380 words mechanized Mil-Spec compliance
5. Parts of Speech Analysis	% of various type of words used	Planned	Not planned
6. Sentence Type	% of various types of sentences used	Planned	Not planned

2.1.1 Spelling Check

The Writer's Workbench spelling check program has an internally developed 30,000 word dictionary with affixes.[1] The program also allows users to add words to tailor the program for themselves. Interactive program features allow users to locate possible misspellings, determine correct spelling, change spelling if necessary, and add words to a personal dictionary.[2]

CRES provides a spelling check in an indirect but interesting way. Any word that is not on the Master Word List is flagged as an uncommon word.[3] The flagged words are thus possible misspellings.

WRITEAIDS uses commercially available spelling check programs.

2.1.2 Punctuation Check

A Writer's Workbench program searches for simple punctuation errors. When this program finds an error it prints the original line and a corrected line. It recommends changes to (1) capitalize the first letter of a sentence, (2) move commas and periods to the left of double quotes and move semicolons and colons to the right of double quotes, and (3) balance double or single quotes and parenthesis.[4]

Punctuation checks are not planned for CRES or WRITEAIDS.

2.1.3 Double Word Check

When the same word appears twice in a row, a Writer's Workbench program flags the double entry even if it is split across two lines. This is a difficult error for humans to detect.[2]

Double word checks are not planned for CRES or WRITEAIDS.

2.1.4 Sexist Language

The Writer's Workbench has a program that identifies terms that might suggest sexual bias in writing.[2] The program contains a dictionary of about 170 words and phrases that may be sexist.

A future version of CRES will have a sexual bias program that complies with military specifications for technical manuals.

WRITEAIDS has a program that checks for sexual bias. The program contains a 380 word sexual bias dictionary.

2.1.5 Parts of Speech Analysis

A parts of speech analysis is performed by a set of Writer's Workbench programs.[5] These programs use a small dictionary, suffix rules, and experimentally derived word order rules to assign word classes to all words in a text. The analysis is about 95 percent accurate. One purpose of these programs is to provide statistics on the percentage and raw count of various word types used in a text. These programs are also used with several other Writer's Workbench programs to be described later.

Parts of speech identifiers are coded with the entries in the CRES Master Word List. Plans for using this data are not yet complete.[6]

Parts of speech data is built into an experimental WRITEAIDS program for computer-aided translation. There are no plans to use such data for other purposes.

2.1.6 Sentence Type Analysis

A Writer's Workbench program performs a sentence-type analysis. The program determines the raw count and percentage of simple, complex, compound, and compound-complex sentences in a document.[5]

A sentence type analysis feature is planned for CRES[6] but not for WRITEAIDS.

2.2 SUGGESTIONS FROM WRITING EXPERTS

Table 2 summarizes automated features that are based on suggestions from writing experts concerning grammar or clear writing principles.

2.2.1 Split Infinitives Check

The use of split infinitives is often considered to be a grammatical error. Using the parts of speech analysis program described in Paragraph 2.1.5, the Writer's Workbench will find infinitives that are split by adverbs.[2] Users can obtain printed grammatical information about split infinitives from another program.

A split infinitive check is not planned for CRES[6] or WRITEAIDS.

2.2.2 "To Be" Check

Some writers, including Lanham, suggest that document revisors should circle all forms of the verb "to be" and try to replace them.[7] Following this advice could help cut down on the use of passive voice, nominalizations (nouns made from verbs), and expletives (words that add no information).

A Writer's Workbench program underlines and capitalizes all forms of "to be". The text printout is formatted normally so potential problems are highlighted in context. Bell reports that this is a useful way to look at the first draft of a paper.[4]

The CRES system is not specifically programmed to find all forms of "to be", but it will locate full passive constructions. A "to be" check is not planned for WRITEAIDS.

2.2.3 Preposition Count

The excessive use of prepositions may indicate wordiness. One output of the Writer's Workbench parts of speech analysis is a preposition count. This data is probably most useful when included in a style comparison (refer to Paragraph 2.3.11).

TABLE 2. SUGGESTIONS FROM WRITING EXPERTS

Feature	Writer's Workbench	CRES	WRITEAIDS
1. Split Infinitive Check	Flags infinitives split by adverbs	Not planned	Not planned
2. "To Be" Check	Flags all forms of "to be"	Passives only	Not planned
3. Preposition Count	Included in parts of speech analysis	Identifies excessive use of prepositions in a sentence	Not planned
4. Wordiness/Phrase Substitution	About 400 phrases mechanized	About 250 phrases mechanized	About 400 phrases mechanized
5. Sentence Opener Check	X	X	Expletive check Planned
6. Clause Length Check	Not Planned	X	Not planned
7. Sentence Type Variability Check	X	Not planned	Not planned
8. Paragraph Length Check	Not planned	X	Planned
9. Organization Check	X	Not planned	Planned

CRES flags sentences containing more than a predetermined number or percentage of prepositions.[8] A preposition count is not planned for WRITEAIDS.

2.2.4 Wordiness/Phrase Substitution

Writing experts have identified several phrases as wordy, awkward, repetitive, or frequently misused. Many such phrases can be replaced with a single word or a shorter phrase.

The Writer's Workbench has a multi-purpose dictionary containing about 400 wordy or frequently misused phrases.[5] String matching programs flag the faulty phrases and suggest one or more substitutes. The writer or editor must decide if a suggested substitute is appropriate in the context in which it would be used. Users can tailor the dictionary to their own needs by adding or deleting terms.

CRES also has a multi-purpose dictionary containing about 250 phrases with as many as two suggested substitutes per phrase.[6,8] As with the Writer's Workbench, CRES users must decide whether suggested substitutes are appropriate. CRES users can tailor the phrase dictionary to their own needs.

WRITEAIDS has a dictionary containing about 400 phrases with one or more substitutes per phrase.[9] The purpose and use of this dictionary are virtually identical to the Writer's Workbench and CRES.

2.2.5 Sentence Opener Check

Writing experts have made two kinds of suggestions about sentence openers. The first is that variety in sentence openers is desirable. The second is that some types of sentence openers are wordy or should be avoided in certain instances.[10]

Using the parts of speech analysis programs, the Writer's Workbench provides statistics on the percentage and raw count of the types of sentence openers used in a text.[5] With experience and the aid of an interpretive program, these statistics can be used to achieve a desirable variety in sentence openers and to avoid the excessive use of undesirable sentence openers such as expletives.

As part of its phrase dictionary software, CRES identifies expletives. Another CRES program advises users to avoid starting sentences with certain subordinate clauses.[8]

The only sentence opener check planned for WRITEAIDS is an expletive check.

2.2.6 Clause Length/Awkwardness Check

Experts, including Klare,[11] advise that clause length is important apart from sentence length. They suggest reducing clause length where possible.

A clause length check is not planned for the Writer's Workbench. CRES flags clauses with more than 10 words and flags awkward dependent clauses.[8] A clause length check could be programmed for WRITEAIDS but is not now planned.

2.2.7 Sentence Type Variability Check

Many experts agree that sentence variety adds to reading pleasure and can help hold a reader's attention.[11,12] Some writers do not realize that their sentences lack variety. Faced with stringent format and style requirements, they may find it difficult to consider sentence variability.

Statistics on sentence variety are provided by the Writer's Workbench.[5] Interpretive programs provide writers with both positive and negative variability characteristics of their text. The program provides numerous suggestions for increasing sentence variety.[2]

Sentence type variability checks are not planned for CRES[6] or WRITEAIDS.

2.2.8 Paragraph Length Check

Long paragraphs can be hard to understand. This is perhaps because the content drifts too far from the main topic or because the writer is poorly organized. A long paragraph check can draw attention to paragraphs that may need to be rewritten.

Paragraph length checks are not planned for the Writer's Workbench. The CRES system flags paragraphs that exceed 10 sentences.[8] A paragraph length check based on a word count is planned for WRITEAIDS.

2.2.9 Organization Check

The organization of a document provides readers with useful clues that aid understanding. Until the 1970's, there was virtually no useful research on organization, so writers relied on the advice of experts. Those experts often recommended that the first sentence of a paragraph should be a topic sentence or should serve as a transition from the previous paragraph to a new topic. While this is sound advice, organization is related to content in other complex ways. The recent research on organization is still quite theoretical[11] and can not yet be automated. Hopefully, future organization suggestions will move into the category of suggestions based on research.

The Writer's Workbench has a useful program to help writers evaluate organization. The program prints paragraph headings and preserves paragraph boundaries, but it prints out only the first and last sentence of each paragraph. This printout can provide an abstract of a paper for writers who use traditional formats; it provides a structural outline for writers with a more casual style.[2]

There are no plans to include an organizational check in the CRES system.

In 1983, research on the practical application of comprehension, coherence, and inference loading theories will begin at Westinghouse. The long range goal is to implement research-based organizational checks in the WRITEAIDS system.

2.3 SUGGESTIONS BASED ON RESEARCH

In this category, the similarities of the three systems are pronounced. The differences between the systems tend to reflect either the organizational goals of Bell Laboratories, TAEG, or Westinghouse or the areas of most interest to the various researchers. There is no doubt that the three organizations are working with the same basic ideas and data. Differences in available hardware and software have led to some of the different approaches for applying the suggestions based on research. Table 3 summarizes automatic features based on research in readability, comprehensibility, psychology, linguistics, and psycholinguistics.

TABLE 3. SUGGESTIONS BASED ON RESEARCH

Feature	Writer's Workbench	CRES	WRITEAIDS
1. Readability Analysis	Flesch, Flesch-Kin. ARI, Col-Liau	Flesch, Flesch-Kin.	Flesch, Flesch-Kin.
2. Test Q Analysis	Not Planned	Readability, item construction	Not planned
3. Readability Sum.	X	Meets Mil-spec	Meets Mil-spec
4. Vocabulary Check	Not planned	4300 root words, plus supplements	Two vocabs. planned
5. Word Substitution	100 root words, less awkward substitutes	250 root words, substitutes based on length	1000 root words, substitutes based on length, fam., freq.
6. Abstract Word Check	Nouns, verbs, adjs.	Planned	Nouns-verbs, adjs.
7. Nominalization Check	X	X	Exception List
8. Long Sen. Ck.	X	X	X
9. Neg. Statement Check	Not planned	Double negs. text - all negs. tests	Direct negs.
10. Passive Check	X	Full passives	X
11. Style Comparator	X	Not planned	Future

2.3.1 Readability Analysis

The term readability analysis, as applied here, refers to predicting the style difficulty of text by readability formula. Readability formulas can be misused because they are not intended to measure content, organization, format, legibility, or other factors considered important to comprehension. Laymen often drop the word "readability" from formula score descriptions and thus tend to equate the scores with age groups or conceptual difficulty, neither of which is correct.

When the data from a readability analysis is properly applied, it can provide valuable insight into potential problems with word use, sentence use, or both. When a thoughtful sampling procedure is used, a readability analysis will also highlight the particular portions of a document that are most likely to need revision. While perhaps hundreds of readability formulas exist, all three organizations agree that the Flesch-Kincaid formula seems to be the most appropriate formula for technical material.[5,3,14]

The Writer's Workbench calculates four readability indices: The Flesch Reading Ease Score[15], The Flesch-Kincaid Formula[16], The Automated Readability Index[17], and The Coleman-Liau Formula[18]. One program prints the four formula scores and provides statistics on the average word and sentence length. Another program interprets the Flesch-Kincaid score for users.[2]

CRES calulates the Flesch Reading Ease Score and the Flesch-Kincaid Formula. The CRES readability analysis provides statistics on the average number of words per sentence and the average number of syllables per word. It also lists the words in a text which do not appear on the Master Word List (refer to Paragraph 2.3.4).

WRITEAIDS also calculates the Flesch Reading Ease Score and the Flesch-Kincaid Formula. The WRITEAIDS readability analysis provides raw data and the same statistical data as CRES. WRITEAIDS also lists words of three or more syllables in the order that the words appeared in the analyzed text.

2.3.2 Test Question Analysis

Research has identified numerous principles for constructing good true-false and multiple-choice test questions. For a summary of that research, see Kincaid, Braby, and Wulfeck.[19] TAEG has a specific need for test question analysis so CRES is the only one of the three systems that automates this feature.

The CRES test question analysis includes all of the regular features of CRES plus several features specified by the Navy's Instructional Quality Inventory[20] (IQI). IQI features for multiple-choice questions include flagging long sentences, inappropriate answers, the fact that the longest answer is correct, and repetitive words and phrases. IQI features for true-false questions include flagging long questions, negative wording, and complex questions.[19]

2.3.3 Readability Summary of Several Passages

A readability summary of the analysis of several passages from the same document helps writers identify specific types of writing or specific parts of a document that are most likely to need revision.

Interpretive programs in the Writer's Workbench provide both tabular and written summaries of the scores for individual passages. Users can compare the summaries for the individual passages. These programs also provide written information on the background that readers might need to understand the document.[2]

Both CRES[6] and WRITEAIDS provide readability summaries that permit a side-by-side comparison of the passages within a document. These summaries include the raw data, index variables, and readability scores for individual passages. Both systems also provide an overall readability analysis of an entire document that complies with military specification requirements.

2.3.4 Controlled Vocabulary Check

Studies show that when the words used in written materials are familiar to intended readers the materials are easier to read and understand. Several researchers have prepared "controlled vocabularies" which permit the use of only those terms that are either known to be familiar or will be taught to intended readers. Many "controlled vocabularies", ranging in length from about 1000 to 4000 root words, have been prepared for technical materials. Two types of "controlled vocabularies" have emerged. The first type is based on word frequency analysis and permits multiple meanings of the same word. The second type is based on the one word-one meaning concept and permits only one shade of meaning for a word.

There are no plans to include a controlled vocabulary in the Writer's Workbench.[13]

CRES has a controlled vocabulary called the Master Word List. This list is based on (1) word frequency analysis of Navy training materials, and (2) word lists prepared by several military and nonmilitary organizations.[3] The Master Word list consists of about 4300 root words plus all inflected forms of the root words. The Master Word List can be tailored to specific audiences by adding supplementary technical terms that are peculiar to special disciplines. CRES flags all words in a text that do not appear on the Master Word List. A writer or editor replaces flagged words with common words where possible.

Two "controlled vocabularies" are planned for WRITEAIDS. The plans are to add the CRES word lists and an internally developed one word-one meaning logistics glossary.

2.3.5 Word Substitution

Readability research has shown that a reader's speed, recall, and comprehension can often be improved if the difficult content words of a passage are changed in certain ways. Words that are shorter, more frequently used, or more familiar tend to improve human performance in reading. See Klare[11] for an extensive discussion of the literature. Word substitution dictionaries are designed to suggest simpler alternatives for the difficult nontechnical words that appear in a passage. Before using a suggested substitute, the writer or editor must make sure that the meaning of the text will not be changed.

The same Writer's Workbench dictionary that lists awkward or misused phrases also contains about 100 words that are potentially awkward. A string matching program flags the difficult words when they occur in a passage. Users can request a printout that suggests one or more shorter substitutes for the flagged words. Users can also tailor the dictionary to their own needs by adding or deleting terms.[4]

The CRES word substitution dictionary contains about 250 potentially difficult root words.[6] CRES automatically flags each word in a passage that matches a word in the dictionary and prints out up to two suggested substitutes.[3] Terms can be added to or deleted from the dictionary.[8]

The WRITEAIDS substitution dictionary contains about 1000 potentially difficult words. WRITEAIDS automatically flags each word in a passage that matches a word in the dictionary and prints out all available suggested substitutes. The dictionary was specially constructed to suggest changes based on readability research. With a few minor exceptions, each suggested substitute is a shorter word, a more familiar word[21], and a more frequently used word.[22] When all appropriate word changes are inserted, the readability grade level of a document is automatically lowered; the probability is that the comprehensibility of the document is also improved.

2.3.6 Abstract Word Check

Concrete words, which easily arouse an image in one's mind, contribute more to readable writing than abstract words. Studies have shown that concreteness can improve human performance scores in recognition and recall memory, readability judgements, sentence usage, information gain, and recognition time. See Klare[11] for a summary of the literature.

The conceptual abstractness of text is checked by a Writer's Workbench program. The program calculates the percentage of words in a text that appear on a list of 314 abstract nouns, verbs and adjectives compiled through psychological research. When the percentage of abstract words exceeds 2.3 percent, the program suggests that concrete examples should be used to clarify the text.[4]

An abstract word check is planned for CRES.

WRITEAIDS contains a list of about 275 abstract nouns, verbs, and adjectives. A string matching program flags each word in the text that occurs on the abstract word list. A user's manual suggests that concrete examples should be used to clarify the text.[23]

2.3.7 Nominalization Check

Excessive use of nominalizations (nouns made from verbs) tends to make text less readable. Studies have shown that replacing nominalizations with the active verb form can improve human performance scores in comprehension, recall, and information gain. See Klare[11] for a summary of the literature.

The Writer's Workbench program for parts of speech analysis identifies nominalizations. Another program calculates the raw count and percentage of nominalizations in the text. An interpretive program advises writers to avoid excessive nominalizations by transforming nominalized sentences to the active verb form.[2]

A nominalization check is available for CRES.[6]

The WRITEAIDS nominalization check is based on the same string matching techniques used in the Writer's Workbench. A special exception dictionary is used to avoid flagging words which are actually verbs or are both nouns and verbs. The program flags each nominalization that occurs in a passage. A user's manual advises writers to transform nominalizations to the active verb form where possible.[23]

2.3.8 Long Sentence Check

Shortened sentences contribute to more readable writing. Research shows that certain sentence changes improve human performance in reading comprehension and speed. See Klare[11] for a discussion of the literature.

A Writer's Workbench program determines the percentage of short and long sentences and the length and location of the shortest and longest sentences in a passage.[5] Another program allows users to locate all sentences that exceed a specified number of words or contain less than a specified number of words.

The long sentence checks in CRES and WRITEAIDS are virtually identical. Both systems automatically flag the end of each sentence that exceeds a specified number of words.

2.3.9 Negative Statement Check

Negative statements sometimes require more time or cause more errors in verifying truth or falsity than affirmative statements.[11] Many negative statements can be transformed into affirmative statements.

A negative statement check is not planned for the Writer's Workbench.

CRES offers two types of negative statement checks. For normal text, CRES flags each sentence containing a double negative. When used to check true-false or multiple-choice test questions, CRES flags any negative construction.

WRITEAIDS flags all occurrences of the direct negatives no, not, or nor. Numerous additional forms of negative constructions have been identified but have not yet been programmed. A user's manual asks writers to transform negative statements to positive statements where possible.[23]

2.3.10 Passive Voice Check

The excessive use of passive sentences is one of the biggest problems in technical writing. Sentences written in passive voice tend to be longer, less direct, and less vigorous than sentences written in active voice.[24] Changing sentences from passive voice to active voice can improve a reader's verification and recall.[11] However, passives are often needed to add variety, emphasize the object of the sentence, or avoid naming an unknown or unimportant actor.

The Writer's Workbench calculates the percentage of passives used and will locate passive constructions on request. An interpretive program advises users on how to revise sentences to avoid the excessive use of passive voice.[2,5]

The CRES system flags each passive sentence that can be transformed to active voice.[8] CRES, therefore, avoids flagging truncated passives which are often impossible to transform.

WRITEAIDS identifies each passive sentence that occurs in a passage. A user's manual advises writers to transform sentences from passive voice to active voice where possible.

2.3.11 Style Comparator

A style comparator not only provides style statistics but it also interprets the statistics. This feature compares the style of a new text against a set of style standards and describes the differences.

Bell Laboratories has prepared several sets of style standards for various types of documents. The style standards reflect the writing from a collection of documents of each type, which were judged to be good.[2] A Writer's Workbench user selects which set of built-in standards should be used to interpret a new document. Users can also tailor standards for a particular audience by creating new standards from a set of documents. The Writer's Workbench style comparator identifies those style values of a new document which are outside the range of the selected standard. A two-to-three page output in written English explains why deviations from the standards may make the new document hard to understand. The same output explains how to rewrite the text to remove problems. Users receive positive feedback when style values meet the built-in standards.[2,4]

A style comparator is not planned for CRES.[6] Funding for development of a WRITEAIDS style comparator has been requested.

3. FEEDBACK PROVIDED BY THE SYSTEMS

The word feedback, as used in this section, refers to the information supplied by the systems to the users. All of the systems allow users to select various program options from a menu; in some instances there are both short and long versions of the same option. The systems provide feedback on either a hard copy printout or a CRT display. This paper will only describe feedback from hard copy printouts.

To obtain data for this section, ten samples of text were analyzed by each of the three systems. Space does not permit showing all of the data (over 150 pages). However, the Appendix contains all of the printouts provided by each system for one of the ten samples. These printouts provide representative examples of many of the text analysis features described in Section 2. Differences between the comparable features of the three systems reflect differences in the algorithms, word lists, and program formats.

3.1 WRITER'S WORKBENCH

The feedback provided by the Writer's Workbench can be grouped into three categories. Those categories are described as statistical analysis, objective analysis, and interpretive analysis. The Appendix shows the Writer's Workbench printouts in the order in which they are discussed.

3.1.1 Statistical Analysis

The Writer's Workbench provides statistical feedback on a wide range of style variables. For a given document, the variables reported include readability indexes, information on average word and sentence lengths, the distribution of sentence lengths and types, the usage of various parts of speech, and the distribution of sentence openers. The data includes both raw counts and percentages. Standing alone, the output of the program that compiles statistical data is most useful for research on the style of documents. However, the output of the program is also used as the input for the interpretive analysis described in Paragraph 3.1.3.

3.1.2 Objective Analysis

The Writer's Workbench performs several tedious and unrewarding tasks that were traditionally done by writers and editors. Proofreading programs check for problems which are objective in nature such as spelling, punctuation, grammar, and sexual bias. An organization program provides a look at the overall structure of a document.

Feedback from the proofreading analysis is provided by English language printouts. The printouts first describe the type of check performed (spelling, punctuation, double word entry, word choice, split infinitives, or sexist language). Next, the printouts identify each possible error found; if no error is found, a brief statement to that effect is printed out. Finally, for each possible error detected, the printout lists suggested corrections or revisions. The decision to accept or reject the suggestions is left to the user.

The organization program preserves the headings and paragraph boundaries of the text, but it prints out only the first and last sentence of each paragraph. The actual evaluation of the text structure is left to the user.

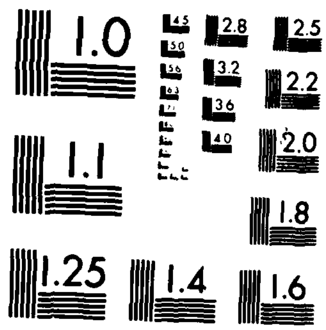
3.1.3 Interpretive Analysis

The output from programs for statistical style analysis is used as the input for interpretive programs available on the Writer's Workbench. The interpretive programs provide users with positive and negative feedback in one of two forms. The longer form provides a written report that discusses in prose how the input text compares with a set of built-in standards. The short form compares the input text with the same standards but prints out only brief comments.

For short documents, the long form starts with a one sentence warning that the interpretive analysis may be misleading. A one sentence note then informs the user of the standards being used to judge the input text. Next, the printout provides a written comparison of the style variables of the input text with the built-in standards. If a particular style variable meets the standard, a short statement to that effect is printed out. If a variable (readability for example) exceeds the standard, the user is provided with a longer report containing remedial information. That information describes the problems that readers may encounter because the standard was exceeded, some reasons why the standard was exceeded, and practical suggestions for improving the text.

AD-A152 549 PROCEEDINGS OF THE ANNUAL MEETING (26TH) TECHNICAL DOCUMENTATION DIVISION..(U) AMERICAN DEFENSE PREPAREDNESS ASSOCIATION ARLINGTON VA 10 MAY 84 3/4

UNCLASSIFIED F/G 5/2 NL



MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

The short form of the interpretive analysis also starts with a warning (for short documents) that the analysis may be misleading. It then lists the style variables analyzed and simply states whether the score for each variable is good or high. If the score is high, the printout suggests what a good score would be and perhaps a brief suggestion for improvement.

3.2 CRES

CRES provides two types of feedback. The first is a statistical analysis and the second is an "in context" analysis. The Appendix shows both types of feedback.

3.2.1 Statistical Analysis

CRES provides statistical feedback on readability and word usage for a particular document. A printout shows the raw count of sentences, words, and syllables, information on average word and sentence lengths, readability indexes, and an alphabetical listing of uncommon words. This type of feedback is useful for evaluating compliance with requirement specifications and highlighting potential areas of style difficulty.

3.2.2 "In Context" Analysis

CRES provides feedback on style analysis by directly flagging potential problems in the context in which they actually occur. Potential problems with particular words or phrases are flagged by bracketing the actual word or phrase with a set of symbols. Uncommon words are bracketed by the symbols "[ ]". Words or phrases for which there are suggested substitutes are bracketed by the symbols " "; suggested substitutes are inserted immediately after flagged items using the same set of symbols. The number of words in a long sentence is printed out within the " " symbols after the sentence identifying punctuation. All comments about style are made within the " " symbols as potential problems occur anywhere in the text. A CRES user's manual explains the meaning of the symbols and provides practical advice for improving text in response to the flagged problems.

3.3 WRITEAIDS

WRITEAIDS also provides two types of feedback. Like CRES, the first is a statistical analysis and the second is an "in context" analysis. The Appendix shows both types of feedback.

3.3.1 Statistical Analysis

WRITEAIDS provides statistical feedback on the readability of a document. A printout shows the raw count of sentences, words and syllables, information on average word and sentence lengths, and readability indices. The same printout also lists the long words in the order in which they occur in the document. Readability statistics and long word lists are useful for evaluating compliance with requirement specifications and highlighting potential areas of style difficulty.

3.3.2 "In Context" Analysis

Like CRES, WRITEAIDS provides feedback on style analysis by identifying potential problems in context. Unlike CRES, comments and suggested changes are made below each line of text instead of being interspersed in the text. Two different types of printouts are used to provide "in context" feedback.

One printout shows suggestions for word substitution and identifies long sentences. This printout shows each line of text exactly as it appears in the document being analyzed. Below each line of text is a list of the words for which there are suggested substitutes; all available suggested substitutes are printed out immediately after each listed word. If a line of text includes the end of a long sentence, a "long sentence" note is printed out below the line. Users can mark accepted word and sentence changes directly on this printout. The printout showing suggestions for phrase substitution is similar to the word substitution printout, but it does not identify long sentences.

The program that produces the printout described in the preceding paragraph also creates a special file (stripped of punctuation) used in other style analysis checks. This file is printed out double spaced. The blank lines below each line of text contain flags that identify potential style problems. For example, the flag NOM appears directly beneath each nominalization. Multiple flags can be printed out for the same word. A user's manual explains the flags and makes practical suggestions for improving the text.

4. USER ACCEPTANCE

Because large scale tests of user acceptance began only recently, there is very little hard data to report on this topic. However, users in general report that the systems are useful, serve their intended purpose, improve the quality of final documents, and may improve the skills of writers and editors. Users also seem to appreciate the impersonal nature of the suggestions made by the systems.

4.1 WRITER'S WORKBENCH

One survey of Writer's Workbench users found that most think the feedback from the system is clear, and the system is likely to find things the user would miss. A significant number of users reported that the system improves their writing skills. Other trials have shown that under time pressure, technical writers detected significantly more planted errors with the system than without it.[2]

4.2 CRES

CRES has been used by two large defense contractors to edit technical manuals. Users report that the use of CRES results in improved documentation with about a 50 percent savings in editing time.[6]

4.3 WRITEAIDS

Experiments using WRITEAIDS to edit technical manuals began in September 1982, so only the general comments made in Paragraph 4 can be made.

5. FUTURE APPLICATIONS

Computer-aided editing systems already provide a wealth of information and numerous ways to apply that information. Future applications or adaptations of the systems seem to be limited only by imagination. Some future uses seem obvious once they are stated; others require insight into the problems faced by readers, writers, and editors. The closing paragraphs of this paper will explore, without elaboration, a wide range of possible applications.

5.1 ADDITIONAL FEATURES

Research on reading and writing has provided some suggestions for improving text that have not yet been automated. Some of these suggestions that could be additional features include:

(1) a check for references back to earlier parts of a text (anaphora),
(2) a check for references forward to later parts of a text (cataphora),
(3) a word association check,
(4) a word depth check, and
(5) a self-embedded statement check.

Future research on reading and writing may provide additional text analysis features. Some possible features are:

(1) an index of conceptual difficulty,
(2) a check on the coherence of a document, and
(3) a measure or check of organization.

Additional objective features that could save production time are:

(1) automatic generation of an index, and
(2) automatic generation of a table of contents (this feature is available at Bell Laboratories)

5.2 ADAPTATION TO OTHER USES

With little or no further development, computer-aided editing can be adapted to other uses. Possible adaptations include:

(1) editing the data base used in computer-aided authoring systems,
(2) using the text analysis features to help writing students analyze their own texts (experiments using the Writer's Workbench are being performed),
(3) using style comparators to help students compare their writing with that of famous writers or with standards,
(4) using style comparators to smooth out differences in style between multiple contributors to the same document, and
(5) using text analysis to help instructors diagnose problems in students' writing.

With further development, software techniques for editing could be combined with software for other applications to help solve problems in other areas. For example:

(1) editing software could be combined with software that divides sentences at pausal boundaries to prepare more understandable CRT messages (this would be especially useful for preparing emergency operating procedures), and
(2) software for parts of speech analysis, word substitution, and phrase substitution could be combined with software for, syntax conversion to prepare fairly high quality translations from English to other languages.

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Many people helped me to prepare this paper. Larry Frase and Nina Macdonald of Bell Laboratories provided several articles about the Writer's Workbench, answered numerous questions, and reviewed the paper for technical content. Mary Fox provided the data from the samples of text she ran on the Writer's Workbench programs. Peter Kincaid of TAEG provided documentation on CRES, answered numerous questions, and reviewed the paper for technical content. Ray Cox provided the data from the samples he ran on CRES. Edward Pierce of Westinghouse ran all of the text samples through WRITEAIDS. Shirley Bloom did all of the typing; Charles Lighthiser and Frank Wojcicki did the editing.

A special acknowledgement is due to the programmers and software designers who have made computer-aided editing a reality. Major contributors at Bell Laboratories include Lorinda Cherry, Stacey Keenan, and Nina Macdonald. Early contributors at TAEG were Nora Gregory, Carolyn Trotta, and Charles Guitard. Ray Cox has been the principal programmer for the last two years. Mr. Edward Pierce prepared all of the computer-aided editing software at Westinghouse.

BIOGRAPHY

J. Douglas Kniffin is a Fellow Engineer with the Technical Data and Training Systems Department, Integrated Logistics Support Divisions, Westinghouse Electric Corporation. He is currently Principal Investigator for IR&D in the area of Technical Manual Technology Research. He participated in the Westinghouse Johns Hopkins Scholarship Award Program and received his BSEE from Johns Hopkins University. He also holds a Doctorate in Law from the University of Maryland. Recently he has been Principal Investigator for several R&D programs in readability/comprehensibility for both Westinghouse and the military services. Doug is currently President of the Metro-Baltimore Chapter of the Society for Technical Communication.

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APPENDIX

WRITER'S WORKBENCH

Aug 24 13:05 1982 THIS IS THE STYLE TABLE FOR kniffin06 Page 1

```
readability grades:
        (Kincaid) 16.2  (auto) 16.5  (Coleman-Liau) 15.2  (Flesch) 17.0 (22.2)
sentence info:
        no. sent 19 no. wds 463
        av sent leng 24.4 av word leng 5.48
        no. questions 0 no. imperatives 0
        no. content wds 262  55.6%   av leng 7.56
        short sent (<19) 16% (3) long sent (>34)  11% (2)
        longest sent 37 wds at sent 2; shortest sent 6 wds at sent 6
sentence types:
        simple  26% (5) complex  47% (9)
        compound  11% (2) compound-complex  16% (3)
word usage:
        verb types as % of total verbs
        tobe  30% (16) aux  21% (11) inf  26% (14)
        passives as % of non-inf verbs  13% (5)
        types as % of total
        prep 12.3% (57) conj 1.9% (9) adv 3.7% (17)
        noun 26.3% (122) adj 16.8% (78) pron 3.9% (18)
        nominalizations   4 % (20)
sentence beginnings:
        subject opener: noun (0) pron (1) pos (0) adj (4) art (4) tot  47%
        prep  16% (3) adv  26% (5)
        verb   0% (0)  sub_conj  11% (2) conj   0% (0)
        expletives   0% (0)
```

****************************** SPELLING ******************************

Possible spelling errors in kniffin06 are:

anaphora

If any of these words are spelled correctly, later type
spelladd word1 word2 ... wordn
to have them added to your spelldict file.

****************************** PUNCTUATION ******************************

The punctuation in kniffin06 is first described.

4 double quotes and 0 single quotes
1 apostrophes
0 left parentheses and 0 right ones

The program next prints any sentence that it thinks is
incorrectly punctuated and follows it by its correction.

No errors found in kniffin06

****************************** DOUBLE WORDS ******************************

For file kniffin06:

No double words found.

****************************** WORD CHOICE ******************************

Sentences with possibly wordy or misused phrases are listed next,
followed by suggested revisions.

For file kniffin06

beginning line 1 kniffin06
Because our *[endeavor]*s to ameliorate readability and text
processing are familiar at numerous echelons of the military,
the requirement for an alteration in our standard demonstration
therefore became obvious.

beginning line 9 kniffin06
Accordingly, you are observing an amalgamation of the products
of our ongoing and future research with our objective being to
exhibit a consolidated demonstration of our efforts at producing
beneficial *[modification]*s in both text and text processing.

beginning line 14 kniffin06

We *[anticipate]* that *[subsequent]* to the termination of
this demonstration, the human propensity to forget all the technicalities
will take effect; however, by retaining the sample transcriptions
provided to you, you can *[facilitat]*e your memory.

beginning line 21 kniffin06
Today we are exhibiting *[one of the]* primary features of our
new computer-aided editing system; this feature has been
*[designat]*ed "the substitution dictionary.

beginning line 31 kniffin06
One list *[compris]*es *[approximately]* 900 difficult words
that frequently appear in technical manuals while the second list
*[compris]*es *[approximately]* 1800 suggested substitutes for
the words in the original list.

beginning line 35 kniffin06
Each substitute was selected to match the shade of meaning of
the difficult word that it might replace, and additionally each
substitute is a shorter, more familiar, and more frequently
*[utiliz]*ed word.

beginning line 42 kniffin06
The text processor is then *[utiliz]*ed to compare each word
in the text with the list of difficult words in the substitution
dictionary.

beginning line 49 kniffin06
The writer must then determine *[which]* word
*[modification]*s can be made without producing an alteration
in the meaning of the text.

beginning line 52 kniffin06
A readability analysis of the edited text can then be
[accomplished] to determine if the text is at an appropriate
level of difficulty for the intended audience.

beginning line 56 kniffin06
[In the near future], we hope to add numerous innovations to
the computer-aided editing system.

beginning line 59 kniffin06
[At this time,] we believe that *[desirable benefits]* will
result *[by means]* of taking advantage of characteristics that
are peculiar to certain structures.

beginning line 63 kniffin06
Other benefits could *[follow after]* we *[conduct an investigation]*
of the *[manner]* in *[which]* writers make references to
other parts of their own writing.

beginning line 66 kniffin06
For example, we believe that the identification of passive voice,
anaphora, and inference loading may be *[practicable]*.

beginning line 70 kniffin06

Furthermore, we are planning to *[implement]* the U.

beginning line 71 kniffin06
Navy's 4000 word controlled vocabulary and to *[fabricate]* our own "Controlled Logistics Vocabulary.

beginning line 72 kniffin06
" Finally, if we *[couple together]* the research on word and phrase substitution, parts of speech analysis, and syntax roles, we will have the *[necessary requisite]*s for *[subsequent]* translation from English to foreign languages.

file kniffin06: number of lines 77 number of phrases found 30

------------------ Table of Substitutions ------------------

PHRASE SUBSTITUTION

accomplished: use "done" for " accomplished"
anticipate: use "expect" for " anticipate"
approximately: use "about, nearly, almost" for " approximately"
at this time: use "now" for " at this time"
by means: use "with, by, through" for " by means of"
compris: use "includes" for " comprise"
conduct an investigation: use "investigate" for " conduct an investigation of"
couple together: use "couple" for " couple together"
designat: use "appoint, name" for " designate"
desirable benefits: use "benefits" for " desirable benefits"
endeavor: use "try" for " endeavor"
fabricate: use "hand made, manufactured, fabricated" for " man made"
fabricate: use "make, build" for " fabricate"
facilitat: use "ease, simplify, help, improve" for " facilitate"
follow after: use "follow" for " follow after"
implement: use "execute, fulfill, achieve" for " implement"
in the near future: use "soon" for " in the near future"
manner: use "like, as" for " after the manner of"
manner: use "precisely, etc." for " in a precise manner"
manner: use "similarly" for " in a similar manner"
manner: use "way" for " manner"
modification: use "change" for " modification"
necessary requisite: use "requisite" for " necessary requisite"
one of the: use "one, a" for " one of the"
practicable: use "possible" for " practicable"
subsequent: use "later, after" for " subsequent to"
subsequent: use "next, later, further" for " subsequent"
utiliz: use "use" for " utilize"
which: use ""that" when clause is restrictive" for " which"
which: use "of which" for " of that"
which: use "when" for " at which time"

----

* Not all the revisions will be appropriate for your document.
* When there is more than one suggestion for just one bracketed word, you will have to choose the case that fits your use.

Aug 24 13:01 1982 PROOFR OUTPUT FOR kniffin06 Page 4

* Capitalized words are instructions, not suggestions.

NOTE: If you want this program to look for additional phrases or to stop looking for some, for instance to stop flagging "impact," type the command dictadd.

************************** SPLIT INFINITIVES **************************

For file kniffin06:

No split infinitives found

Aug 24 13:05 1982 SEXIST OUTPUT FOR kniffin06 Page 1

file kniffin06: number of lines 79 number of phrases found 0

ORG OUTPUT FOR kniffin06

SAMPLE 6

Because our endeavors to ameliorate readability and text processing are familiar at numerous echelons of the military, the requirement for an alteration in our standard demonstration therefore became obvious. We anticipate that subsequent to the termination of this demonstration, the human propensity to forget all the technicalities will take effect; however, by retaining the sample transcriptions provided to you, you can facilitate your memory.

Today we are exhibiting one of the primary features of our new computer-aided editing system; this feature has been designated "the substitution dictionary. Each substitute was selected to match the shade of meaning of the difficult word that it might replace, and additionally each substitute is a shorter, more familiar, and more frequently utilized word.

Frequently a writer ascertains from readability analysis that a text is likely to be too difficult for the intended audience. A readability analysis of the edited text can then be accomplished to determine if the text is at an appropriate level of difficulty for the intended audience.

In the near future, we hope to add numerous innovations to the computer-aided editing system. Finally, if we couple together the research on word and phrase substitution, parts of speech analysis, and syntax roles, we will have the necessary requisites for subsequent translation from English to foreign languages.

BECAUSE YOUR TEXT IS SHORT (< 2000 WORDS & < 100 SENTENCES), THE FOLLOWING ANALYSIS MAY BE MISLEADING.

NOTE: Your document is being compared against standards derived from 30 technical memoranda, classified as good by managers in the research area of Bell Laboratories.

READABILITY

The Kincaid readability formula predicts that your text can be read by someone with 16 or more years of schooling, which is rather high for this type of document. Good technical documents average close to 13th grade level, even though the audience has more education than that.

This text includes many long words. Consider running the syllable counting program, syl, to look at the words in this text with five or more syllables. To do this type the following command when this program is done.

```
syl -5 filename
```

If most of the long words are technical terms that you must use, consider providing a glossary of terms to make this paper easier to read. If the words aren't technical terms, use shorter words wherever you can. In changing your text, be sure not to use several different words for the same concept; such synonyms are frequently confusing to the reader.

VARIATION

You have an appropriate distribution of sentence types.

SENTENCE STRUCTURE

Passives and Nominalizations

You have appropriately limited your use of passives and nominalizations (nouns made from verbs, e.g. "description").

PROSE OUTPUTS

Options

You can request that your document be compared against different standards; typing -t with the prose command, e.g.,

```
prose -t filename
```

will compare your text against training documents.

A -s option will provide a very short version of the prose output.

prose -s filename

If you already have a style table in a file, you can save time by using it as the input to prose rather than the textfile. To do this, precede the style table filename with a -f, e.g.,

prose -f styletable-filename

All the options can be selected at the same time and listed in any order.

prose -f styletable-filename -s -t

Statistics

The table of statistics generated by the program style can be found in your file styl.tmp. If you want to look at it type:

cat styl.tmp

You can also use the match program, which provides a better format, type:

match styl.tmp

If you are not interested in the file, remove it by typing:

rm styl.tmp

ORGANIZATION

The prose program cannot check the content or organization of your text. One way to look at the overall structure of your text is to use grep to list all the headings that were specified for the mm formatter. To do this, type:

grep '^\.H' filename

You can also use the organization program, org, to look at the structure of your text. Org will format your paper with all the headings and paragraph divisions intact, but will only print the first and last sentence of each paragraph in your text so you can check your flow of ideas.

org filename

Texts differ in the extent to which they refer to concrete objects and abstract ideas. Concrete objects, places, or things can be seen, heard, felt, smelled, or tasted. Abstract ideas, on the other hand, cannot be experienced by our senses. From the results of psychological research, we know that concrete texts are easier to read, easier to use, and easier to remember.

In file "kniffin06," 3.7 percent of the words are abstract words, which is a high score.

Texts with more than about 2% abstract words are abstract. A sample of Plato's Symposium has 4.41% abstract words. It begins, "For we have a custom, and according to our custom any service to another under the idea that he will be improved..." On the other hand, a text with no abstract words contains this passage: "The explosion of a gaseous mixture such as hydrogen and oxygen,..."

One way to improve such text would be to add concrete examples to explain the abstract ideas.

The abstract words in file "kniffin06" are stored in file "ab.kniffin06". Remove it if you wish.

FILE ab.kniffin06

```
   3 substitute
   2 technical
   2 future
   2 believe
   1 standard
   1 original
   1 objective
   1 necessary
   1 memory
   1 forget
   1 compare
   1 advantage
```

```
prose -t -s -f sty.kniffin06
BECAUSE YOUR TEXT IS SHORT (< 2000 WORDS & < 100 SENTENCES),
THE FOLLOWING ANALYSIS MAY BE MISLEADING.

Compared to training material.

Reading grade level--16.2: Very high,  Good score = >7.8 - 12.4
Variation--Too many compound + compound-complex sentences (27%).
         --Sentences are long--avg length = 24.4 words
                               --Good length = 15.0 to 20.2
         >>Shorten sentences by dividing into simple and complex.
Passives--13.0%: Good
Nominalizations--4.0%: High, Good score = 0% - 3.4%

prose -tm -s -f sty.kniffin06
BECAUSE YOUR TEXT IS SHORT (< 2000 WORDS & < 100 SENTENCES),
THE FOLLOWING ANALYSIS MAY BE MISLEADING.

Compared to technical papers.

Reading grade level--16.2: High,  Good score = >10.1 - 15.0
Variation--Good sentence type distribution.
Passives--13.0%: Good
Nominalizations--4.0%: Good
```

APPENDIX

CRES

--------------- READABILITY RESULTS ---------------

Number of Sentences	Number of Words	Number of Syllables
21	466	864

Aver. Number of Words per Sentence	Avg. Number of Syllables per Word
22.19	1.85

GRADE LEVEL (Based on DOD Readability Standard)
14.9

---------- WORDS NOT ON COMMON WORD LISTS ----------

WORD	FREQ	WORD	FREQ
alteration	2	non-technical	1
alterntive	1	ongoing	1
amalgamation	1	practicable	1
ameliorate	1	propensity	1
anaphora	1	readability	4
audience	2	requisites	1
augment	1	roles	1
computer-aided	2	substitution	4
desirable	1	syntax	1
dictionary	1	technicalities	1
elementary	1	transcriptions	1
example	1	translation	1
fabricate	1	vocabulary	1
inference	1	writer	2
innovations	1		

Because our <endeavors><*TRIES/*> to [ameliorate] [readability] and text processing are familiar at <numerous><*MANY/MOST*> <echelons><*LEVELS/*> of military, the <requirement><*NEED/*> for an [alteration] in our standard demonstration <therefore><*SO/*> became obvious.<*031*> <Accordingly,><*SO/*> you are <observing><*SEEING/OBEYING*> an [amalgamation] of the products of our [ongoing] and future research with our <objective><*AIM/GOAL*> being to <exhibit><*SHOW/*> a <consolidated><*UNITED/MADE FIRM*> demonstration of our efforts at producing <beneficial><*HELPFUL/*> <modifications><*CHANGES/*> in both text and text processing.<*037*><* TOO MANY (07) PREPOSITIONS *> We <anticipate><*EXPECT/*> that <subsequent to><*AFTER/LATER*> the <termination of><*ENDING/FINISHING*> this demonstration, the human [propensity] to forget all the [technicalities] will take <effect;><*MAKE/BRING ABOUT*> however, by <retaining><*KEEPING/*> the sample [transcriptions] <provided><*GAVE/GIVEN/SUPPLIED*> to you, you can <facilitate><*EASE/HELP*> your memory. Today we are <exhibiting><*SHOWING/*> one of the primary features of our new [computer-aided] editing system; this feature has been <designated><*CERTAIN/CHOSEN*> "the [substitution] [dictionary."] One purpose of a [substitution] [dictionary] is to [augment] [readability] by suggesting [alternative] [elementary] words to replace the difficult [non-technical] words in a text.<*024> The [dictionary] <incorporates><*BLENDS/JOINS*> two word lists. One list

<comprises><*FORMS/INCLUDES*> <approximately><*ABOUT/*> 900 difficult words that frequently <appear><*SEEM/*> in technical manuals while the second list <comprises><*FORMS/INCLUDES*> <approximately><*ABOUT/*> 1800 suggested substitutes for the words in the original list.<*029*> Each substitute was <selected><*CERTAIN/*> to match the shade of meaning of the difficult word that it might replace, and additionally each substitute is a shorter, more familiar, and more frequently <utilized><(USED/*> word.<*032*> Frequently a [writer] <ascertains><*FINDS OUT/LEARNS*> from [readability] analysis that a text is likely to be too difficult for the intended [audience.] The text processor is then <utilized><*USED/*> to compare each word in the text with the list of difficult words in the [substitution] [dictionary.]<*023*><* TOO MANY (05) PREPOSITIONS *> When a word in the text corresponds to a word in the difficult word list, the text processor prints out the corresponding substitute words.<*024*> The [writer] must then <determine><*DECIDE/FIGURE*> which word <modifications><*CHANGES/*> can then be made<* PASSIVE VOICE *> without producing an [alteration] in the meaning of the text. A [readability] analysis of the edited text can then be <accomplished><*CARRIED OUT/DID/DONE*> to <determine><*DECIDE/FIGURE*> if the text is at an <appropriate><*PROPER/RIGHT*> level of difficulty for the intended [audience.]<*027*><*TOO MANY (05) PREPOSITIONS *> In the near future, we hope to add <numerous><*MANY/MOST*> [innovations] to the [computer-aided] editing system.<* TOO MANY

(04) PREPOSITIONS *> At this time, we believe that [desireable] <benefits><*HELPS/IS HELPED*> will result by means of taking advantage of characteristics that are <peculiar to><*RELATING/*> certain structures.<*023*> Other <benefits><*HELPS/IS HELPED*> could follow after we conduct an investigation of the manner in which writers make references to other parts of their own writing.<*024*><*TOO MANY (05) PREPOSITIONS *> For [example,] we believe that the identification of passive voice, [anaphora,] and [interference] loading may be [practicable.] Futhermore, we are planning to <implement><*CARRY OUT/DO*> the U.S. Navy's 4000 word controlled [vocabulary] and to [fabricate] our own "Controlled Logistics Vocabulary." Finally, if<*SUBORINATE CLAUSE *> we couple together the research on word and phase [substitution,]<* CLAUSE TOO LONG *> parts of speech analysis, and [syntax] [roles,] we will have the necessary [requisites] for <subsequent><*LATER/NEXT*> [translation] from English to foreign languages.<*033*>

Appendix 16

APPENDIX

WRITEAIDS

NAME OF SAMPLE TEXT: SAMPLE 6   17 SEP 82

File begins with:

Because our endeavors to ameliorate readability and text processing are familiar at numerous echelons of the military, the

LONG WORDS:

endeavors	ameliorate	readability
processing	familiar	numerous
echelons	military	requirement
alteration	demonstration	therefore
obvious	Accordingly	observing
amalgamation	objective	exhibit
consolidated	demonstration	producing
beneficial	modifications	processing
anticipate	subsequent	termination
demonstration	propensity	technicalities
however	retaining	transcriptions
provided	facilitate	memory
exhibiting	primary	computer-aided
producing	alteration	readability
analysis	edited	accomplished
determine	appropriate	difficulty
intended	numerous	innovations
computer-aided	editing	desirable
benefits	advantage	characteristics
peculiar	benefits	investigation
references	example	identification
anaphora	inference	practicable
Furthermore	implement	vocabulary
fabricate	Logistics	Vocabulary
Finally	together	substitution
analysis	necessary	requisites
subsequent	translation	languages

SUMMARY AND CALCULATIONS:

NUMBER OF SENTENCES= 21
NUMBER OF WORDS= 463
NUMBER OF SYLLABLES= 869
AVERAGE SENTENCE LENGTH= 22.0
AVG SYLLABLES PER WORD= 1.88
FL-KIN GRADE LEVEL EQUIV= >15

SUMMARY AND CALCULATIONS:

NUMBER OF SENTENCES= 21
NUMBER OF WORDS= 463
NUMBER OF SYLLABLES= 869
AVERAGE SENTENCE LENGTH= 22.0
AVG SYLLABLES PER WORD= 1.88
FLESCH INDEX= 25.7
GRADE LEVEL EQUIV= 16.6

NAME OF SAMPLE TEXT: SAMPLE 6

Because our endeavors to ameliorate readability and text
---endeavor try, attempt
---ameliorate improve, better

processing are familiar at numerous echelons of the military, the
---familiar well known
---numerous many, some
---echelon level

requirement for an alteration in our standard demonstration therefore
---requirement need
---alteration change
---demonstration show
---therefore so

became obvious. Accordingly, you are observing an amalgamation of
---obvious plain, clear
-SENTENCE GREATER THAN 20 WORDS.-
---Accordingly therefore, so, then
---observing noting, seeing
---amalgamation combination, blend, mixture

the products of our ongoing and future research with our objective
---ongoing present
---objective aim, goal

being to exhibit a consolidated demonstration of our efforts at pro-
---exhibit show, present
---consolidate unite, combine, join
---demonstration show

ducing beneficial modifications in both text and text processing. We
---producing making
---beneficial helpful
---modification change
-SENTENCE GREATER THAN 20 WORDS.-

anticipate that subsequent to the termination of this demonstration,
---anticipate expect
---subsequent next, later, after
---termination end, conclusion
---demonstration show

the human propensity to forget all the technicalities will take
---propensity tendency
---technicalities details

effect; however, by retaining the sample transcriptions provided to
-SENTENCE GREATER THAN 20 WORDS.-
---however but, though
---retaining keeping, holding
---transcription copy
---provided given

you, you can facilitate your memory.
---facilitate make easy, help

Today we are exhibiting one of the primary features of our new
---exhibiting showing, presenting
---primary major, first, main, basic

computer-aided editing system; this feature has been designated "the
---designate name, appoint, choose, pick, select

substitution dictionary." One purpose of a substitution dictionary

is to augment readability by suggesting alternative elementary words
---augment increase
---alternative choice, choice of, option
---elementary basic, simple

to replace the difficult non-technical words in a text. The diction-
---difficult hard
-SENTENCE GREATER THAN 20 WORDS.-

ary incorporates two word lists. One list comprises approximately
---incorporate combine, include, join
---comprise consist, contain, include, make up
---approximately about, almost

900 difficult words that frequently appear in technical manuals while
---difficult hard
---frequently often

the second list comprises approximately 1800 suggested substitutes
---comprise consist, contain, include, make up
---approximately about, almost

for the words in the original list. Each substitute was selected to
---original first, new
-SENTENCE GREATER THAN 20 WORDS.-

match the shade of meaning of the difficult word that it might
---difficult hard

replace, and additionally each substitute is a shorter, more
---additionally too, also

familiar, and more frequently utilized word.
---familiar well known
---frequently often
---utilize use
-SENTENCE GREATER THAN 20 WORDS.-

Frequently a writer ascertains from readability analysis that a
---Frequently often
---ascertain find out, learn, make sure

text is likely to be too difficult for the intended audience. The
---difficult hard

text processor is then utilized to compare each word in the text with
---utilize use

the list of difficult words in the substitution dictionary. When a
---difficult hard
-SENTENCE GREATER THAN 20 WORDS.-

word in the text corresponds to a word in the difficult word list,
---correspond agree, match
---difficult hard

the text processor prints out the corresponding substitute words.
---corresponding agreeing, matching
-SENTENCE GREATER THAN 20 WORDS.-

The writer must then determine which word modifications can be made
---determine decide, find out
---modification change

without producing an alteration in the meaning of the text. A read-
---producing making
---alteration change
-SENTENCE GREATER THAN 20 WORDS.-

ability analysis of the edited text can then be accomplished to
---accomplished expert, done

determine if the text is at an appropriate level of difficulty for
---determine decide, find out
---appropriate proper, set aside
---difficult hard

the intended audience.
-SENTENCE GREATER THAN 20 WORDS.-

In the near future, we hope to add numerous innovations to the
---numerous many, some
---innovation change

computer-aided editing system. At this time, we believe that desir-

able benefits will result by means of taking advantage of character-
---benefit help

istics that are peculiar to certain structures. Other benefits could
---characteristic feature, quality, trait
---peculiar odd, strange, special
-SENTENCE GREATER THAN 20 WORDS.-
---benefit help

follow after we conduct an investigation of the manner in which

writers make references to other parts of their own writing. For
-SENTENCE GREATER THAN 20 WORDS.-

example, we believe that the identification of passive voice,

anaphora, and inference loading may be practicable. Furthermore, we
---practicable can be done, possible
---Furthermore also, too, besides

are planning to implement the U.S. Navy's 4000 word controlled vocab-
---implement follow, effect, tool

ulary and to fabricate our own "Controlled Logistics Vocabulary."
---fabricate build, make

Finally, if we couple together the research on word and phrase

substitution, parts of speech analysis, and syntax roles, we will

have the necessary requisites for subsequent translation from English
---necessary needed
---requisite needed
---subsequent next, later, after

to foreign languages.
-SENTENCE GREATER THAN 20 WORDS.-

NAME OF SAMPLE TEXT: SAMPLE 6

NEG/NOM/ABSTRACT WORD CHECK

Because our endeavors to ameliorate readability and text processing are familiar

at numerous echelons of the military the requirement for an alteration in
'NOM 'NOM

our standard demonstration therefore became obvious Accordingly you are observing
'NOM

an amalgamation of the products of our ongoing and future research with our
'NOM

objective being to exhibit a consolidated demonstration of our efforts at
'NOM 'ABS

producing beneficial modifications in both text and text processing We anticipate
'NOM

that subsequent to the termination of this demonstration the human propensity
'NOM 'NOM

to forget all the technicalities will take effect however by retaining the

sample transcriptions provided to you you can facilitate your memory Today
'NOM

we are exhibiting one of the primary features of our new computer-aided editing

system this feature has been designated the substitution dictionary One purpose
'NOM

of a substitution dictionary is to augment readability by suggesting alternative
'NOM

elementary words to replace the difficult non-technical words in a text The

dictionary incorporates two word lists One list comprises approximately 900

difficult words that frequently appear in technical manuals while the second

list comprises approximately 1800 suggested substitutes for the words in
'ABS

the original list Each substitute was selected to match the shade of meaning
'ABS

of the difficult word that it might replace and additionally each substitute
'ABS

is a shorter more familiar and more frequently utilized word Frequently a

writer ascertains from readability analysis that a text is likely to be too

difficult for the intended audience The text processor is then utilized to

compare each word in the text with the list of difficult words in the substitution
'NOM

dictionary When a word in the text corresponds to a word in the difficult

word list the text processor prints out the corresponding substitute words
'ABS

The writer must then determine which word modifications can be made without
'NOM
producing an alteration in the meaning of the text A readability analysis
'NOM
of the edited text can then be accomplished to determine if the text is at
an appropriate level of difficulty for the intended audience In the near
future we hope to add numerous innovations to the computer-aided editing
'NOM
system At this time we believe that desirable benefits will result by means
of taking advantage of characteristics that are peculiar to certain structures
'ABS
Other benefits could follow after we conduct an investigation of the manner
'NOM'ABS
in which writers make references to other parts of their own writing For
'NOM
example we believe that the identification of passive voice anaphora and
'NOM
inference loading may be practicable Furthermore we are planning to implement
'NOM
the U.S Navy's 4000 word controlled vocabulary and to fabricate our own Controlled
Logistics Vocabulary Finally if we couple together the research on word and
phrase substitution parts of speech analysis and syntax roles we will have
'NOM
the necessary requisites for subsequent translation from English to foreign
'NOM
languages

26th ANNUAL MEETING

TECHNICAL DOCUMENTATIO

"SOFTWARE DOCUMENTATION"

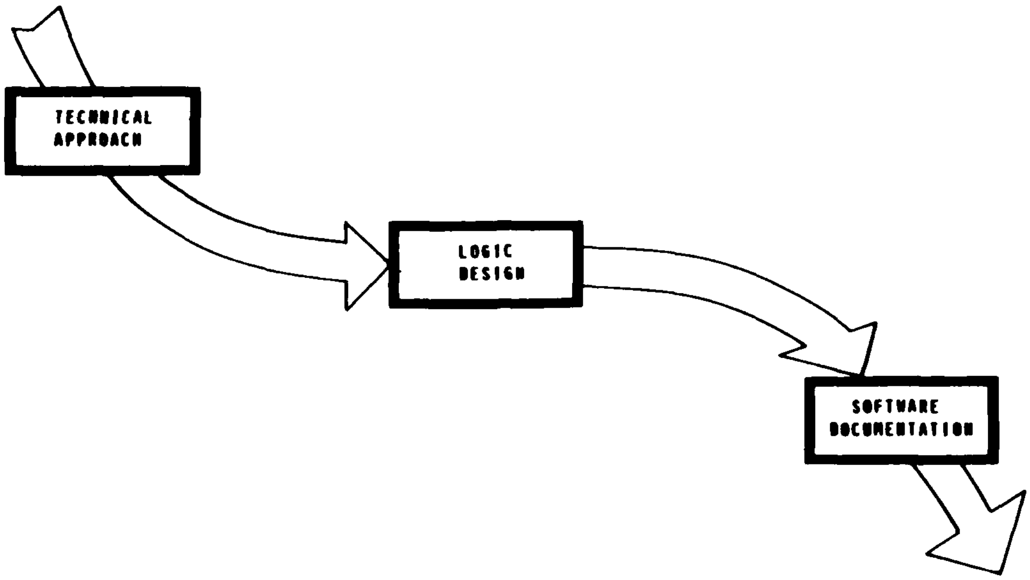
MAY 10, 1984

MARTIN C. OLSON
APPLIED TECHNOLOGY CORPORATION

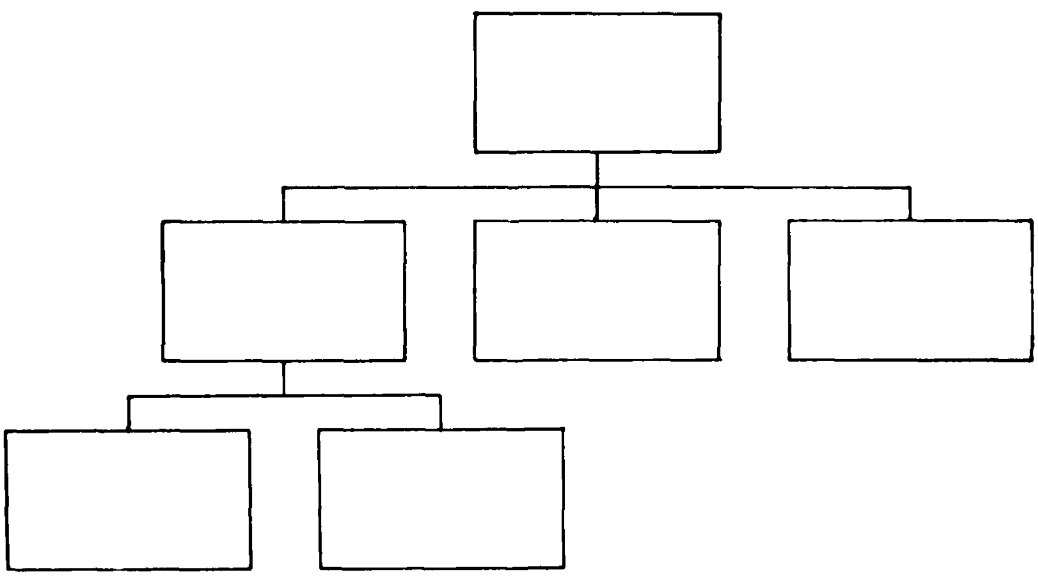
P

SOFTWARE DOCUMENTATION PROCESS

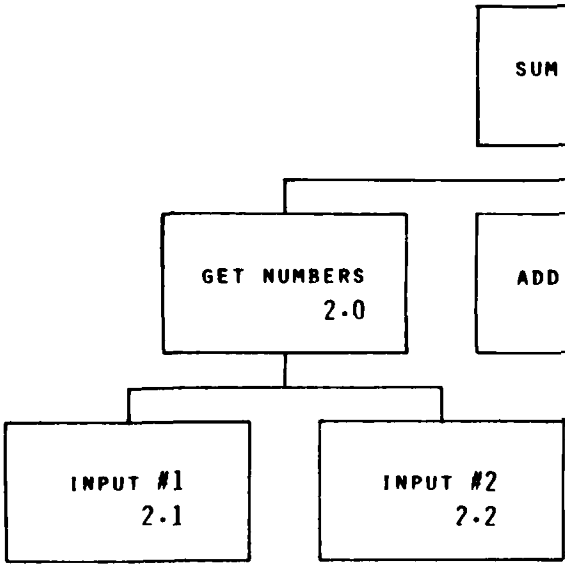
"SIMPLIFIED"



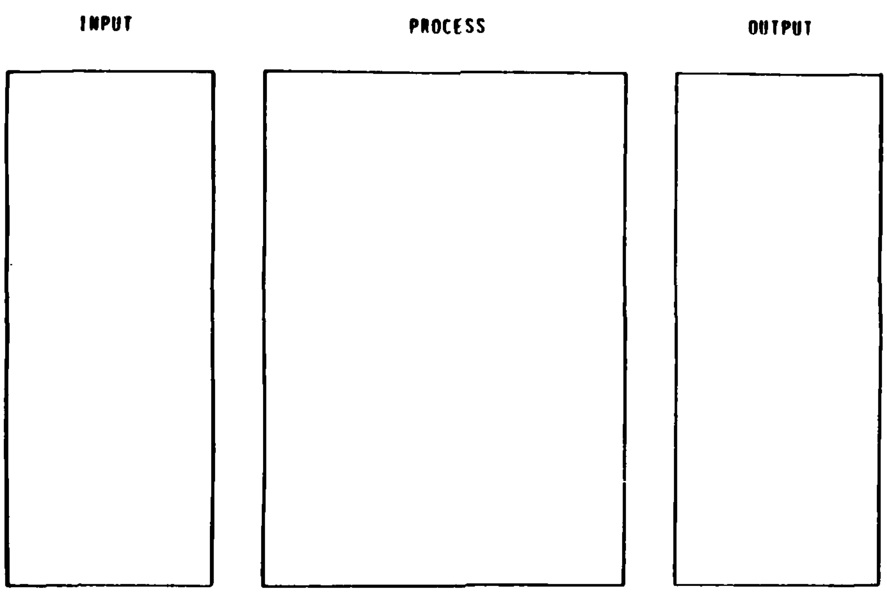
HIERARCHY CHART: "BUBBLE-CHARTING"

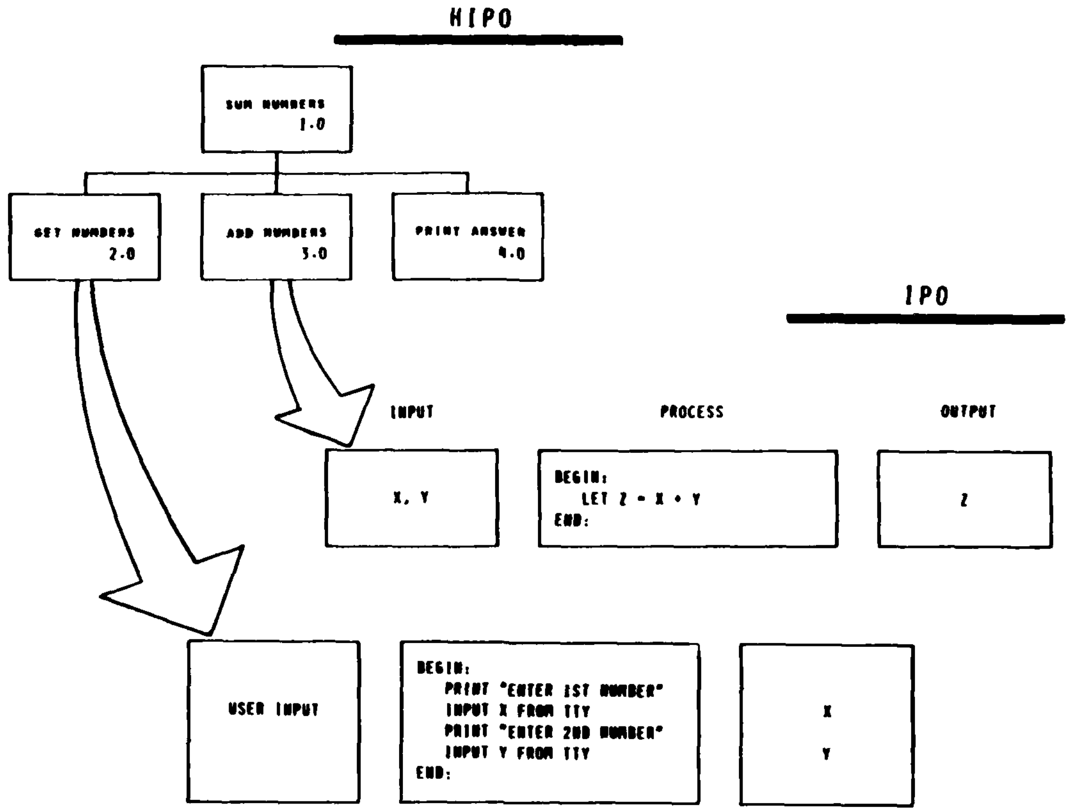


HIERARCHY CHART: "BUBBLE-CHARTING"



INPUT - PROCESS - OUTPUT (IPO) CHART



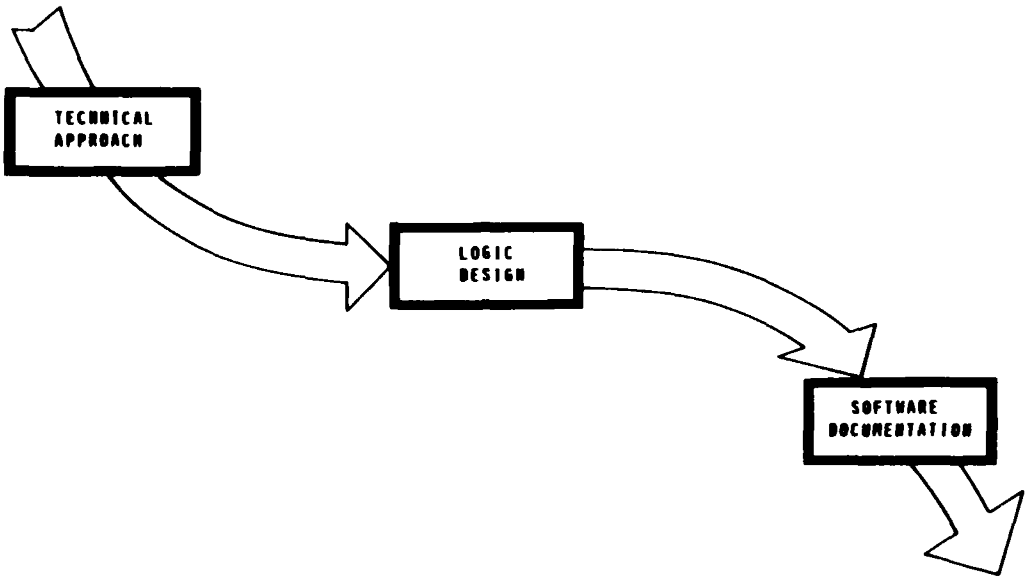


REAL PROGRAMMERS
DON'T
DOCUMENT.

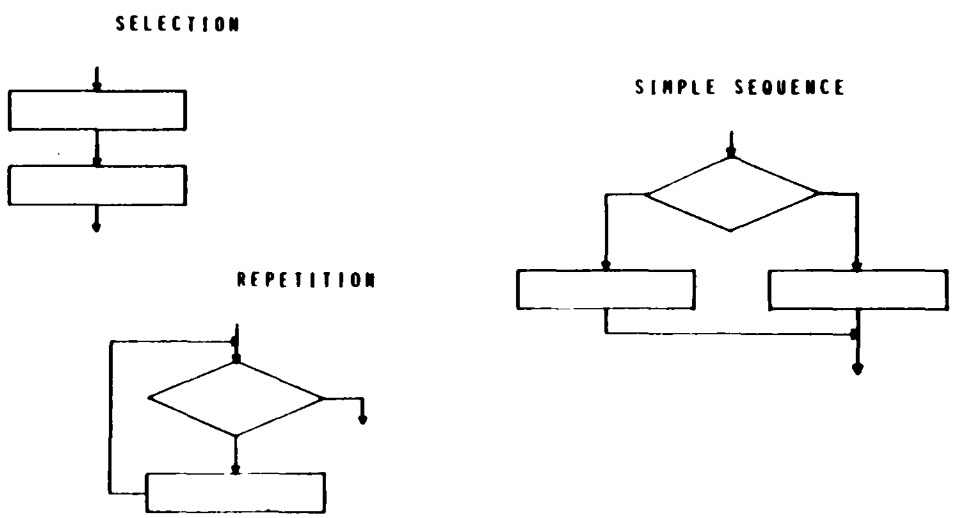
DOCUMENTATION IS FOR WIMPS
WHO CAN'T READ THE CODE !!!

SOFTWARE DOCUMENTATION PROCESS

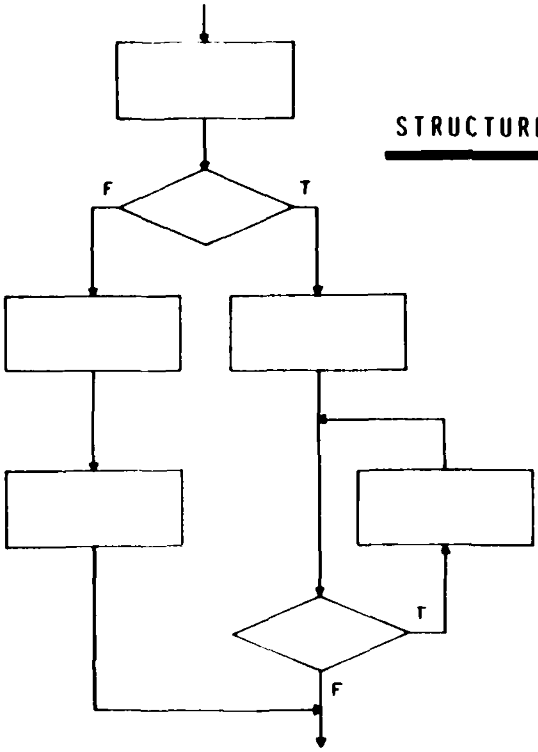
"SIMPLIFIED"



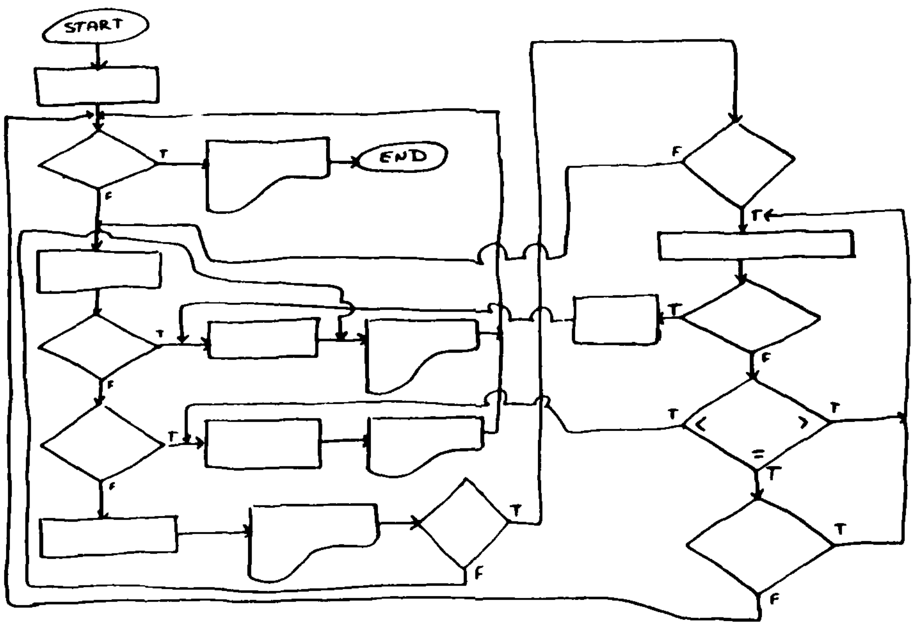
BASIC SEQUENCES OF STRUCTURED PROGRAMMING



STRUCTURED PROGRAM FLOWCHART



SPAGHETTI CODE



REAL PROGRAMMERS'
PROGRAMS NEVER WORK RITE
THE FIRST TIME.

OF COURSE, THEY CAN BE PATCHED INTO
WORKING ORDER IN ONLY A
FEW 30-HOUR DEBUGGING SESSION !!!

STRUCTURED PROGRAM CODE

```
0900     INPUT "HOW MANY RECORDS TO WRITE"; J%
1000     OPEN "DB82:" FOR OUTPUT AS FILE #2%, ORGANIZATION VIRTUAL
1005     FOR K% = 1% TO J%
1010       FOR I% = 0% TO 7%
1020           INPUT "NAME OF BOOK"; BOOK_NAME$
1030           INPUT "RETRIEVAL NUMBER"; RET_NUM%
1040           INPUT "SUBJECT AREA"; SUBJ$
1050           MOVE TO #2%, FILL$ = I% * 64%, BOOK_NAME$, RET_NUM%, SUBJ$
1060       NEXT I%
1070     PUT #2%
1080     NEXT K%
1090     CLOSE #2
```

STRUCTURED PROGRAM CODE WITH ANNOTATED COMMENTS

```
        .TITLE    MYROUTINE
        .ENTRY    START,M^< >              ; BEGINNING OF ROUTINE
CLCR    R0                                 ; CLEAR REGISTER
LABT:   SUBL3     #10,4(AP)R2              ; SUBTRACT 10
LAB2:   BRB       CONT                     ; BRANCH TO ANOTHER ROUTINE

             0
             0
             0

        MOVAL     STR_1,RO                 ; GET ADDRESS OF STRING
                                           ; DESCRIPTOR
        MOVZWL    (R0),R1                  ; GET LENGTH OF STRING
        MOVL      4(R0),R0                 ; GET ADDRESS OF STRING

             0
             0
             0

        MOVL      #^A/ABCD/,R0             ; MOVE CHARACTERS A,B,C,D
                                           ; INTO R0 RIGHT JUSTIFIED WITH
                                           ; "A" IN LOW-ORDER BYTE AND "D"
                                           ; IN HIGH ORDER BYTE
        COMPW     #^A/XY/,R0               ; COMPARES X AND Y AS ASCII
                                           ; CHARACTERS WITH CONTENTS OF
                                           ; LOW ORDER 2 BYTES OF R0
        .QUAD     ^A%1234/678%             ; GENERATE 8 BYTES OF ASCII DATA
        MOVL      #^A/AB/,R0               ; MOVE ASCII CHARACTERS AB INTO
                                           ; R0; "A" IN LOW-ORDER BYTE; "B"
                                           ; IN NEXT; AND ZERO THE 2 HIGH-
                                           ; ORDER BYTES
```

REAL PROGRAMMERS

DON'T

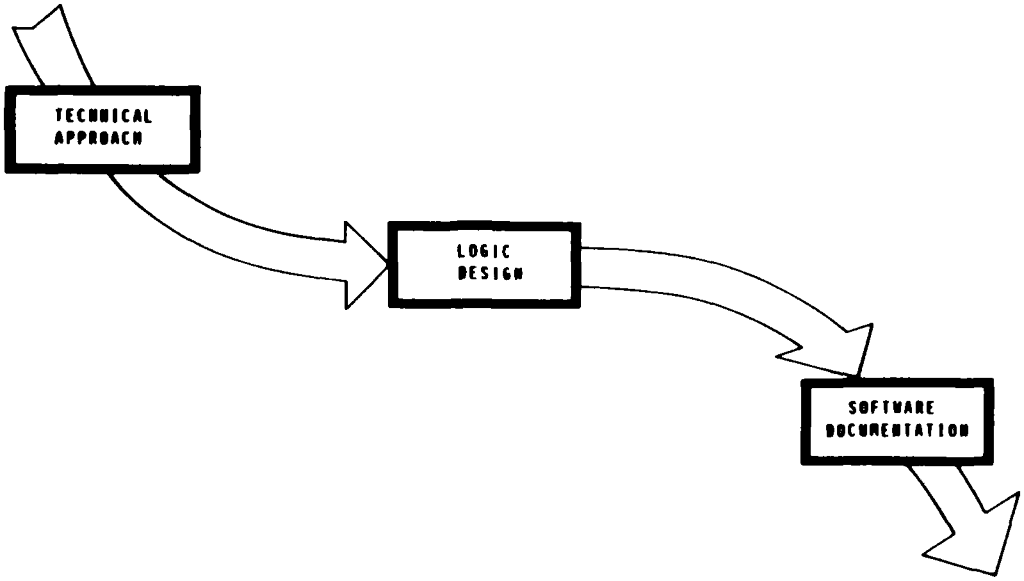
COMMENT THEIR CODE.

IF IT WAS HARD TO WRITE,

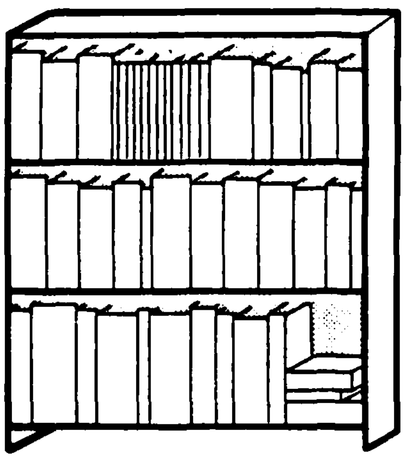
IT SHOULD BE HARD TO UNDERSTAND !!!

SOFTWARE DOCUMENTATION PROCESS

"SIMPLIFIED"



SOME SOFTWARE DOCUMENTATION PRODUCTS



CONCEPT STATEMENT

FUNCTIONAL DESCRIPTION

SYSTEM SPECIFICATION

DATA ELEMENT DICTIONARY

PROGRAM SPECIFICATION

DATA BASE SPECIFICATION

COMPUTER OPERATIONS MANUAL

PROGRAM MAINTENANCE MANUAL

TEST PLAN

IMPLEMENTATION PLAN

TRAINING GUIDE

USER'S MANUAL

REAL PROGRAMMERS
DON'T
WRITE SPECS.

USERS SHOULD CONSIDER THEMSELVES LUCKY

TO GET ANY PROGRAMS AT ALL

... AND LIKE WHAT THEY GET !!!

RAYTHEON

RAYTHEON COMPANY
BEDFORD LABORATORIES
CONFIGURATION MANAGEMENT
OF
COMPUTERIZED DESIGN DATA

26th ANNUAL ADPA-TDD
SAN ANTONIO, TEXAS
8-11 MAY, 1984

PRESENTED BY:
K.E. FOSTER
RAYTHEON COMPANY
MISSILE SYSTEMS DIVISION

RAYTHEON

CONFIGURATION MANAGEMENT CHALLENGES

- DESIGN AND IMPLEMENT AN EFFECTIVE CM CONTROL SYSTEM IN AN R&D ENVIRONMENT TO:
  - CAPTURE ENGINEERING AUTOMATED DESIGN DATA
    - USING COMPUTERVISION (C/V)
  - CONTROL THE DESIGN DATA BASE
    - IN A MULTI-PROGRAM ENVIRONMENT
  - UPDATE THE AUTHORIZED DESIGN IN THE DATA BASE
  - BUILD HISTORICAL RECORDS OF DESIGN REVISIONS
  - SECURE THE FILES IN A CM CONTROLLED FACILITY
  - CONTROL ACCESS TO APPROVED DESIGN DATA
  - PROVIDE BACKUP RECOVERY

- DESIGN AND IMPLEMENT AN EFFECTIVE CM CONTROL SYSTEM IN AN R&D ENVIRONMENT TO:
  - LET ENGINEERING DESIGN EFFORTS CONTINUE WITHOUT CM CONTROLS
  - REDUCE COSTS OF DRAWING GENERATION/MAINTENANCE
  - PROVIDE INTERACTIVE OUTPUT TO SUPPORT SYSTEMS INTERFACE (NETWORKING)
  - DEVELOP ALTERNATIVES FOR DELIVERABLE DATA

THE RESPONSE

- CONFIGURATION CONTROL IS ESTABLISHED PRIOR TO DOCUMENTATION RELEASE/APPROVAL CYCLES
  - CM IS ON-SITE IN COMPUTER CENTER
  - DIRECT INTERFACE WITH DESIGN ACTIONS — SECURE DESIGN DATA
  - APPROVES AUTHORIZED CONFIGURATIONS —PRIOR TO UPDATE CYCLES
  - BUILDS HISTORICAL FILE — RELEASES/CHANGES
  - ONSITE LIBRARY — UNDER CM CONTROL
  - CONTROL BACKUP (RECOVERY) SYSTEM
  - PASSWORD CONTROL — AUTHORIZED ACCESS ONLY
  - DESIGN EFFORTS CONTINUE — CM HAS AUTHORIZED CONFIGURATION
  - CREATE "PAPER" DRAWINGS — MYLAR ONLY WHEN REQUIRED
  - C/V DESIGNS UPDATED ON C/V
  - CREATE "BRIDGE" DATA OUTPUT — FEED ADMINISTRATIVE SYSTEMS
  - C/V OUTPUT TAPE COPY — COM — MICROFORM + PAPER DRAWINGS
  - NETWORK TIES RAYTHEON MANUFACTURING FACILITIES TOGETHER

COMPUTERVISION SYSTEM PROFILE BEDFORD LABORATORIES

CURRENT C/V NETWORK

- BEDFORD — MULTIPLE WORK STATION ENVIRONMENT
- NEW DESIGNS USE C/V
- ALL DATA AVAILABLE TO ALL WORK STATIONS
- RELEASE AND USE OF DATA IS VIA ELECTROSTATIC PLOTTER TO MAKE DRAWINGS
- CENTRALIZED FILES SIMPLIFY CM —

  SINGLE DATA BASE TO CONTROL

  ON "HOST" COMPUTER
- MANUFACTURING HAS ACCESS TO ALL DESIGN INFORMATION
- RELEASE TO MANUFACTURING CAN BE MADE IN BEST FORM
  - DATA BASE
  - MAGNETIC TAPE
  - COM
  - HARD COPY
  - COMBINATION OF ABOVE

PLANNING CONSIDERATIONS

- UNDERSTANDING THE COMPUTERVISION SYSTEM
  - DEFINED THE CM ROLE
  - ESTABLISHED A WORKING MODEL (FLOW AND PROSE)
  - TIMING FACTORS — WHERE IS CM INSERTED? RESPONSE TIME REQUIREMENTS DEFINED
- DEVELOPMENT OF CM TRAINING PROGRAM
  - CLASSROOM TRAINING
  - HANDS ON THE SYSTEM
  - DATA BASE PROTECTION AND STORAGE CONCEPTS
- ASSIGN CM PERSONNEL TO C/V FACILITY
  - ONE FULL TIME INDIVIDUAL PLUS BACKUP
- CREATE A SECURED LIBRARY FACILITY
  - ON-SITE — LOCKED-FILES — RESTRICTED ACCESS
- CM HAS DEDICATED DISK DRIVE
  - PLUS CM CONTROLLED DISK PACKS
- ALL CM DATA RESIDES ON HOST COMPUTER
  - IS CENTRAL CONTROL POINT FOR ALL WORK STATIONS
- PROVISIONS FOR BACKUP RECOVERY SYSTEM
  - TAPE COPIES STORED OFFSITE — UNDER CM CONTROL

MANAGING IMPLEMENTATION

- BUILD A CM DATA BASE SYSTEM
  - CREATED FROM DRAFTING DATA BASE
    - AFTER ENGINEERING SIGNS ELECTROSTATIC PRINTER PREPARED (PAPER) DRAWINGS
  - DRAFTING FILE ACCESSED BY CM THRU HOST COMPUTER
    - REFORMATTED FOR CM RETRIEVAL REQUIREMENTS
  - PASSWORD PROTECTED
    - CM APPLIES SECURITY PASSWORD
  - CONTAINS NEW RELEASES AND UPDATE DESIGN DATA
  - UNDER CM CONTROL PRIOR TO CCB APPROVALS
  - NON-APPROVAL BY CCB REQUIRES:
    - CM TO PASS SECURED DATA BACK TO DRAFTING DATA BASE
    - DRAFTING FILE IS RE-CREATED FROM THE CM DATA BASE SINCE:
    - CM CONTROLS THE AUTHORIZED CONFIGURATION SUBMITTED TO CCB
  - OBTAIN CCB APPROVALS
    - SIGNATURES ON ENGINEERING RELEASE/CHANGE ORDERS
  - MICROFILM PAPER "MASTERS" AND RELEASE/CHANGE DOCUMENTATION
  - CREATE CM BACKUP FILES
  - PERFORM DATA BASE AUDITS
    - HARD COPY vs CM DATA BASE RECORDS

CONFIGURATION MANAGEMENT
OF
COMPUTER AUTOMATED DESIGN

DATA BASE STRUCTURE

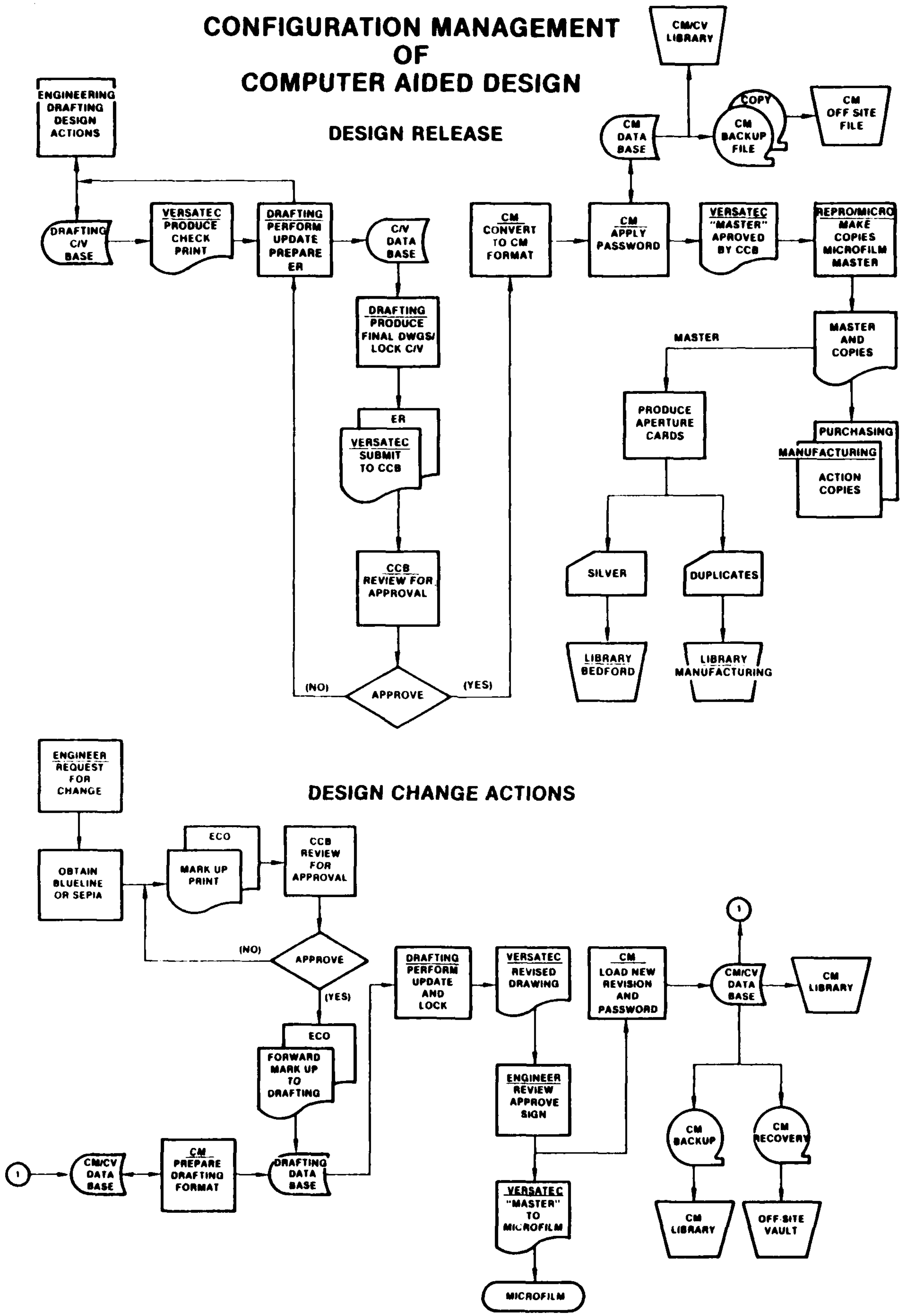
1. DRAFTING RECORD

	DEPT NO.	REQ NO.	PROJ CODE	DOC NO.	SHEET NO.	REV
• ONE SHEET DRAWING	7187	XXXX	SPSK CAN	797XXX		R(X)
• MULTI SHEET DRAWING	7187	XXXX	SPSK RAL	797XXX	SHX	R(X)
• PL's	7187	XXXX	SPSK CAN	PL797XXX		R(X)
• PL's MULTI SHEET	7187	XXXX	SPSK CAN	PL797XXX	SHX	R(X)

2. CONFIGURATION MANAGEMENT RECORD

PROJ CODE	DOC NO.	SHEET NO.	REV	PASSWORD
• SPSK CAN	797XXX	SHX	R(X)	XXXXXX

CONFIGURATION MANAGEMENT OF COMPUTER AIDED DESIGN



DATA BASE DISSEMINATION

PRESENTED TO AMERICAN DEFENSE PREPAREDNESS ASSOCIATION
TECHNICAL DOCUMENTATION DIVISION ANNUAL MEETING
SAN ANTONIO, TEXAS
10 MAY 1984

EARNEST W. DEADWYLER

The professional community represented here is well aware of the proliferation of data bases and the means to access them which have been developed in recent years, as indicated by previous presentations and working sessions. This proliferation has led to increasing interest in both the Government and defense industry in methods for improving access to the data bases and dissemination of information regarding the contents, as well as dissemination of the contents themselves.

The purpose of my presentation is to acquaint you with several activities which have taken place recently in the Government/industry defense community related to a part of this area of interest. One result of this activity has been a suggestion that a separate section be formed within the Technical Documentation Division to focus on the general subject of data base dissemination. At this point our focus is limited but we hope in the future to broaden the scope to provide a means of linking the common interest in data base dissemination among all the sections.

A good starting point for looking at data base dissemination is the technical information centers or technical libraries of defense organizations or defense contractors. Typically, as shown on this chart, these activities interface with several different types of external data base.

The commercial data bases (DIALOG, ORBIT, AND BRS (Bibliographic Retrieval Service)) shown in the lower left box provide access to several hundred technical journal and periodical bibliographic data bases, including many foreign publications. Technical librarians are able to conduct on line searches of these data bases and obtain printouts of search results in varying degrees of detail. Documents may be ordered online for expedited delivery by mail, or they may be obtained from the local library.

The Defense Marketing Service provides a computer searchable data base containing information which has for many years been provided in hard copy form to subscribers. It also includes additional defense related documents, such as the text of defense official's presentations to Congress and defense budget information when released to the public. Contract and market intelligence information can be researched and results compiled quickly using online searches to avoid time consuming manual searches through many volumes of hard copy.

The Online Computer Library Center maintains an extensive data base of catalog information for newly published books and books held by libraries throughout the country. It provides assistance to subscribers in preparing library card catalogs and in locating and obtaining books and periodicals via interlibrary loans.

Most of you are familiar with the Defense Technical Information Center, or DTIC, which is the Defense Department's repository for a wide range of technical reports and defense research and development planning data. The contents include the R&D program planning data base, which is currently in a holding state since input was cutoff by DoD directive in June 1982. I will have more to say about this later. The data bases also include the research and technology work unit information system (WUIS) with data concerning work in progress, the technical reports data base with reports of work completed, and an independent research and development data base. The latter is available only to Government agencies.

There are currently 719 subscribers to the Defense RDT&E Online System, or DROLS, about 360 of whom are contractors. Most of the users access the DTIC data bases via a dialup terminal. These users are able to conduct online searches and display or printout unclassified data from searches and to order documents on line. This expedites identifying and obtaining needed documents to support ongoing research and development programs and program planning. 103 users (92 Government and 11 contractors) have the capability for online access and display of classified information in the data bases via a terminal equipped with a cryptographic interface. This further expedites obtaining data through the ability to obtain classified data at the time of the search, rather than having to wait until the classified search results are received by mail. Unfortunately, the procedures for obtaining classified terminal access are somewhat cumbersome and time consuming and only a limited number of contractors have succeeded in acquiring the capability.

In addition to DTIC, defense R&D technical and planning information is made available to the defense community through tri-service industry information centers in Washington, Dayton, and Los Angeles. The dedicated staff in these agencies works hard and does an outstanding job with the resources available to meet the information needs of defense industry; however, policies and procedures imposed by the Department of Defense frequently make it very difficult for contractors to obtain needed information.

The need to improve the defense technical information program was recognized over three years ago. On 17 and 18 March 1981 Dr. George Gamota, then the Director of the Research and Technical Information in the Office of the Deputy Undersecretary of Defense Research and Engineering (Research and Advanced Technology) sponsored a conference for research and development managers to discuss ways for improvement. This conference brought together a large cross section of government and industry research and development managers. The issues addressed included: technical information program management, technical document production and access, computerized information systems and data bases, and information transfer services and applications.

The major recommendations developed during this conference are summarized at the bottom of this vugraph. The first recommendation shown has been implemented and Dr. Leo Young, current Director of Research and Laboratory Management in OUSDRE, serves as the DoD focal point for technical information. Dr. Young has also implemented the second recommendation with the formation of an Information for Industry Committee having representatives from OSD and the three services. He has recently indicated that a representative of DTIC will be added to the committee.

As far as is known, action has been started but not completed on the remaining three recommendations. DTIC has reportedly compiled a data base with information on over 400 defense related data bases, but this data base has been given only limited distribution and is not available to contractors. Both Government and contractor users report continuing difficulty with obtaining access to some military publications, such as specifications and standards, technical orders, and technical and field manuals. A military publications user group has been formed to identify problems and seek help in this area.

Comments of the participants in the working session on information systems and data bases at this conference are summarized on the next vugraph.

As is the case with any data base accessible to a wide variety of users it was considered essential that the information systems be user oriented and that users be able to have personal contact with the person having the data or entering it into the data base so as to resolve questions. It was also emphasized that the person responsible for providing the data must be responsible for the quality, quantity, and timeliness of the data.

The necessity for multiple levels of data bases and accessibility was noted, with each dependent upon the composition and utilization of the data base. It was also pointed out that there is a distinction between hard fact data and planning data. The Information Analysis Centers were noted as having a unique capability to interpret hard data and go beyond the basic task of providing factual data or identification of references containing data. Participants in this conference were also of the opinion that the technical problems associated with internetting data bases would be difficult and costly to resolve and that for the next several years interface with the data bases by human operators would be required.

Almost two years after the DoD technical information conference for R&D managers, on 7 and 8 December 1982, another conference was sponsored by OSD to assess defense industry's requirements for DoD technical and planning information. This conference included working sessions on three topics: industry perception of current and future scientific and technical information programs, technical information and planning requirements of industry, and improving the DoD/industry information exchange process.

In the working session on technical information and planning requirements for industry it was noted that contractors were finding increasing difficulty in obtaining defense requirements and planning data and technical information. The difficulties being encountered seemed to be at variance with the perceived need to improve the acquisition process expressed in the Carlucci initiatives of April 1981 and statements regarding the Independent Research and Development program made by Dr. Delauer in Congressional testimony in April 1982. Guidance from OSD regarding the dissemination of information and data to industry mentioned the importance of seeking ways to save money, maintaining an ethical distance between DoD and industry without becoming adversarial, technical collaboration with industry, and creation of an environment which encouraged industry to develop innovative concepts complementing and broadening the spectrum of concepts developed internally within DoD.

One of the most important recommendations made by participants in this nference was that the DTIC research and development plann data base which had been cancelled in June 1982 be restor or replaced. DTIC has been directed by OSD to initiate ac ons to this end. This is viewed by many users as an oppo unity for overall improvement in the accessibility of search and development planning information.

It was also recommend that information sources for use by industry be expanded t include the "data base of data bases" mentioned earlier, nd information covering foreign technology.

Improved access to e data bases was also recommended, including insuring th data was complete and timely and that contractors be rovided some insight into projected future threats and req rements to meet them as perceived by defense planners. Th outstanding services provided by the staff of the tri-serv e information centers was recognized and it was recommendad hat they be expanded.

The Defense RDT&E O ine System was recognized as being highly effective and one time a leader in the data base dissemination arena, but it was the opinion of many participants in this nference that many improvements were needed to update the stem to the current state of the art as being implemented the civilian sector. It was also suggested that proc lures be improved to give small contractors access defense technical and planning information through i rovements in programs for potential contrators to become r istered as DTIC users.

A general improvement consistency of policy and procedures followed by the servic in the dissemination of information to defense contractor and in communicating with individual contractors and indust groups was recommended.

One result of this c ference was the creation of the DoD Information for Indu ry Committee mentioned previously. Members of this com ttee are shown on this vugraph. An industry advisory grou has also been formed to help DoD keep attuned to the needs o industry and to help in effecting the exchange of defense in rmation needed by industry. Members of this group are show on this vugraph.

In the preceding comments I have tried to acquaint you with actions taken over the past several years in a very narrow area of data base dissemination. The number and extent of data bases is continually increasing in all segments of industry as we enter the age of the "information society". This provides major challenges to maintain familiarity with the wide variety of highly specialized data bases and continuing improvements in the software and hardware tools available to disseminate them. There are many exciting developments on the horizon - and some even closer - which promise significant increases in our capabilities to interact with data bases and extract information from them.

In the defense area one of the most interesting developments is a gateway system along the lines of a technical information system developed by Lawrence Livermore Laboratories which has the potential to revolutionize the dissemination of data base information. This system will provide the capability to link people, information centers, and computers and provide a very simple and user friendly interface to a wide variety of data bases.

The system would have the capability to function as an electronic switch, protocol translator, superintelligent terminal, communications interface, and transaction controller. This would streamline, speed up, and modernize the search process by providing a fast smart robot to do the drudge work of data access. The system would enable the researcher to connect to a variety of data bases, search for and locate data, and obtain a single printout with an appropriately formatted final report containing the search results.

Considering the present scope of activity and the potential of new developments such as this we believe that the formation of a new section in the Technical Documentation Division is appropriate and timely. However; even with the formation of a new section we realize that it will be difficult to cover the data base dissemination field adequately. Our proposed approach is to begin in a limited area with which we are somewhat familiar and where there are already known challenges, then to expand activity as participation and interest increases. We will try to keep our focus within manageable limits and to be successful in those things we do tackle so we can build on success. The primary focus will be on ways to improve defense productivity through better dissemination and utilization of data base resources.

The areas which have been identified for future action include:

Working with the DROLS User Council and DoD Information for Industry Committee to seek continued improvement in the system.

Seeking improvements in the procedures for qualified contractors to obtain sponsorship and validations required for a classified terminal interface with the DTIC data bases.

Seeking improvement in the accessibility and availability of military publications for all users.

Pushing for an improvement in the quality and timeliness of the research and development planning data base and access to it by DTIC users.

Working with other sections of the division to identify and categorize the wide variety of data bases in use and ways to improve dissemination and linkage among them.

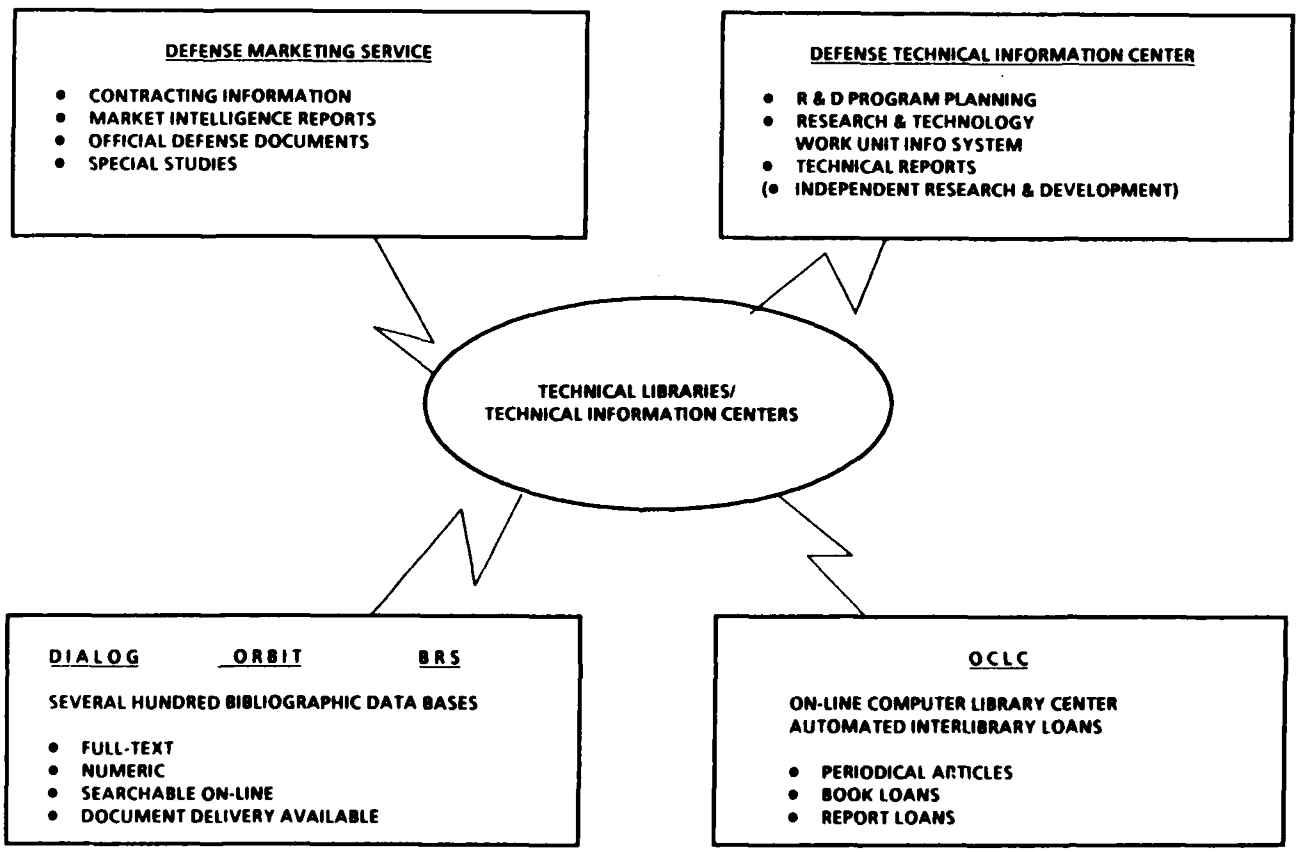
A key focus of all these efforts will be to simplify ways in which computer resources and data are utilized.

DATA BASE DISSEMINATION

EARNEST W. DEADWYLER

TEXAS INSTRUMENTS, INC.

TYPICAL INDUSTRY TECHNICAL LIBRARY/INFORMATION CENTER
EXTERNAL DATA BASE INTERFACES



DOD TECHNICAL INFORMATION CONFERENCE FOR R&D MANAGERS
16-17 MARCH 1981

- OBJECTIVE:

  BRING TOGETHER A LARGE CROSS SECTION OF DOD INHOUSE AND CONTRACTOR SCIENTISTS, ENGINEERS, AND TECHNICAL MANAGERS TO ASSIST IN PLANNING THE DEFENSE SCIENTIFIC AND TECHNICAL PROGRAM (STIP)

- ISSUES:

  - TECHNICAL INFORMATION PROGRAM MANAGEMENT
  - TECHNICAL DOCUMENT PRODUCTION AND ACCESS
  - COMPUTERIZED INFORMATION SYSTEMS AND DATA BASES
  - INFORMATION TRANSFER SERVICES AND APPLICATIONS

- RECOMMENDATIONS:

  - APPOINT A DOD TECHNICAL INFORMATION FOCAL POINT
  - CREATE AN ADVISORY COUNCIL ON TECHNICAL INFORMATION
  - DEVELOP A PLAN TO SUPPORT THE DEFENSE STIP
  - DTIC PROVIDE A "DATA BASE OF DATA BASES"
  - IMPROVE CONTRACTOR ACCESS TO MILITARY PUBLICATIONS

SUMMARY OF COMMENTS REGARDING INFORMATION SYSTEMS AND DATA BASES

- INFORMATION SYSTEMS MUST BE USER ORIENTED
- PERSON ENTERING DATA MUST BE RESPONSIBLE FOR QUALITY, QUANTITY, AND TIMELINESS
- PROLIFERATION OF DATA BASES IS NECESSARY BECAUSE OF THE WIDE VARIETY OF TOPICS THAT NEED TO BE COVERED
- INFORMATION ANALYSIS CENTERS (IAC) CAN BE CONSIDERED AS HAVING A UNIQUE CAPABILITY TO INTERPRET DATA AND PRESENT INFORMATION
- TECHNICAL PROBLEMS ASSOCIATED WITH INTERNETTING DATA BASES WILL BE DIFFICULT AND COSTLY AND FOR THE NEXT SEVERAL YEARS INTERFACE TO THE DATA BASES BY HUMAN OPERATORS WILL BE REQUIRED

DOD/INDUSTRY TECHNICAL INFORMATION CONFERENCE
7-8 DECEMBER 1982

- OBJECTIVE:

  TO ASSESS DEFENSE INDUSTRY'S REQUIREMENTS FOR DOD TECHNICAL AND MANAGEMENT PLANNING INFORMATION

- WORKING SESSION TOPICS:

  - INDUSTRY PERCEPTION OF CURRENT AND FUTURE DOD SCIENTIFIC AND TECHNICAL INFORMATION PROGRAMS
  - TECHNICAL INFORMATION AND PLANNING REQUIREMENTS OF INDUSTRY
  - IMPROVING THE DOD/INDUSTRY INFORMATION EXCHANGE PROCESS

DOD PERCEPTION/GUIDANCE REGARDING DATA BASE DISSEMINATION

- SEEK WAYS TO SAVE MONEY THROUGHOUT ALL PHASES OF THE ACQUISITION PROCESS
- MAINTAIN AN ETHICAL DISTANCE IN BUSINESS RELATIONSHIPS BETWEEN DOD AND INDUSTRY WITHOUT BECOMING ADVERSARIAL
- MAINTAIN TECHNICAL COLLABORATION WITH INDUSTRY TO ACHIEVE MAJOR SYSTEMS OBJECTIVES AND MEET TECHNOLOGICAL CHALLENGES
- CREATE AN ENVIRONMENT WHICH ENCOURAGES DEVELOPMENT OF INNOVATIVE CONCEPTS WHICH COMPLEMENT AND BROADEN THE SPECTRUM OF CONCEPTS DEVELOPED INTERNALLY TO DOD

DOD/INDUSTRY TECHNICAL INFORMATION CONFERENCE
7-8 DECEMBER 1982

RECOMMENDATIONS

- REPLACE R&D PLANNING SUMMARY (DD-1634) DATA BASE WITH NEW ON-LINE DATA BASE

  - RETAIN PRESENT DD-1634 DATA BASE ON LINE FOR AT LEAST 2 YEARS TO MAKE DATA AVAILABLE WHICH IS USEFUL BEYOND CURRENT YEAR

  - ENSURE THE NEW DATA BASE IS SEARCH-COMPATIBLE WITH WORK UNIT INFORMATION SYSEM AND TECHNICAL REPORT DATA BASES

- EXPAND INFORMATION SOURCES FOR USE BY INDUSTRY

  - ADD MORE DATA BASES TO DEFENSE RDT&E ON-LINE SYSTEM (DROLS) (e.g., HOW TO GET IT, DATA BASE OF DATA BASES, ETC).

  - PROVIDE ADDITIONAL INFORMATION ABOUT FOREIGN TECHNOLOGY (e.g., COVERAGE, ACCESS, AVAILABILITY OF TRANSLATIONS, ETC).

- IMPROVE ACCESS TO INFORMATION USEFUL TO PLANNERS; REALIZING THAT THE INFORMATION MUST BE TIMELY, COMPLETE, AND CONTAIN PROJECTIONS FOR THE FUTURE

  - EXPAND SERVICES AND STAFF AT TRI-SERVICE INDUSTRY INFORMATION CENTERS (TIIC)

  - EXPAND COVERAGE AT TIICs TO INCLUDE INFORMATION FROM OTHER DOD AGENCIES, AND PROCUREMENT PLANNING DATA AND INFORMATION

  - HAVE MORE CONVENIENT AND TIMELY ACCESS TO DOCUMENTS CITED IN RFPs, (e.g., STANDARDS, SPECIFICATIONS, FORMS, ETC)

RECOMMENDATIONS (Cont'd)

- IMPROVE DROLS TO MAKE SYSTEM MORE USER-FRIENDLY AND MORE RESPONSIVE TO SUBSCRIBER
- INVESTIGATE OTHER METHODS OF PROVIDING/HANDLING DATA, SUCH NETWORKING AND/OR GATEWAY PROGRAMS AND SYSTEMS
- IMPROVE THE PROCEDURES FOR RELEASING LIMITED DOCUMENTS TO INDUSTRY AND IMPROVE THE PROCEDURES FOR HANDLING DTIC's FORM 55 (REQUEST FOR LIMITED DOCUMENT)
- STANDARDIZE POTENTIAL CONTRACTOR PROGRAM AMONG DOD COMPONENTS AND IMPROVE ACCESS OF POTENTIAL CONTRACTORS TO NECESSARY INFORMATION

- ENSURE CONSISTENCY AMONG THE MILITARY SERVICES AND DOD COMPONENTS WHEN THEY INTERPRET AND IMPLEMENT DOD POLICY, DIRECTIVES, AND INSTRUCTIONS
- ESTABLISH BETTER MEANS OF COMMUNICATING WITH INDUSTRY AND INDUSTRY GROUPS

DOD INFORMATION FOR INDUSTRY COMMITTEE (IIC)

- PURPOSE:

  HELP FORMULATE POLICY AND GUIDANCE FOR THE EXCHANGE OF DEFENSE TECHNICAL AND PLANNING INFORMATION

- MEMBERS:

MR. KARL BASTRESS	DARCOM
MR. WALTER BLADOS	AFSC
DR. PARIS GENALIS	OUSDRE
MR. MARTIN PEARL	NAVMAT
MR. GEORGE POLLACK	NOSC
MR. FRANK SOBIESZCZK	OUSDRE
DR. LEO YOUNG	OUSDRE

INDUSTRY ADVISORY GROUP

- PURPOSE:

  - HELP DOD KEEP ATTUNED TO THE NEEDS OF INDUSTRY

  - HELP IN EFFECTING THE EXCHANGE OF DEFENSE INFORMATION NEEDED BY INDUSTRY

- MEMBERS:

MR. EARNEST DEADWYLER	TEXAS INSTRUMENTS
MS MARGO GIARDANO	HONEYWELL
MR. JOHN KEEHNER	GOODYEAR AEROSPACE
MS DIANE LAFFERMAN	ROCKWELL INTERNATIONAL
MR. FRED LEWIS	HUGHES AIRCRAFT
MS LUCILLE MCCLURE	MARTIN MARIETA AFROSPACE
MR. NATHAN MCGREW	GENERAL DYNAMICS

DATA BASE DISSEMINATION SECTION

PROPOSED APPROACH

- BEGIN WITH MANAGEABLE AND RECOGNIZED DATA BASE DISSEMINATION CHALLENGES
- WORK WITH EXISTING COMMITTEES, USER GROUPS, AND ADVISORY GROUPS TO SOLVE RECOGNIZED PROBLEMS AND IDENTIFY ADDITIONAL PROBLEMS
- EXPAND AS PARTICIPATION AND INTEREST INCREASES. STRIVE TO SUCCEED AND BUILD ON SUCCESS
- FOCUS ON WAYS TO IMPROVE DEFENSE PRODUCTIVITY THROUGH BETTER UTILIZATION OF DATA RESOURCES

PLANS

- WORK WITH DROLS USER COUNCIL AND DOD INFORMATION FOR INDUSTRY COMMITTEE TO SEEK CONTINUED DROLS UPGRADE
- SEEK IMPROVEMENTS IN PROCEDURES FOR QUALIFIED CONTRACTORS TO OBTAIN CLASSIFIED TERMINAL INTERFACE WITH DTIC DATA BASES
- SEEK IMPROVEMENT IN ACCESSIBILITY AND AVAILABILITY OF MILITARY PUBLICATIONS FOR ALL USERS
- SEEK TO IMPROVE QUALITY OF RESEARCH AND DEVELOPMENT PLANNING DATA BASE AND DATA BASE ACCESS BY CONTRACTORS
- WORK WITH OTHER TECHNICAL DOCUMENTATION SECTIONS TO IDENTIFY DATA BASES IN USE AND IMPROVE DISSEMINATION AND LINKAGE

WORKSHOP PANEL SUMMARY REPORTS

ADPA
TECHNICAL DOCUMENTATION DIVISION
1984 ANNUAL MEETING
Workshop #1 - Data Management

1. Attendance; 64 (27 Government - 42%, 37 Industry -58%) (See Attachment)

2. Intent: The intent of this half-day workshop was to provide a forum for attendees from Government and Industry having similar functional interests and responsibilities to foster person-to-person discussions of mutual interest; this dialogue to bring about increased awareness of current issues and concerns being faced by either and/or both sides; to promote greater understanding; to provide opportunities to enumerate successes. In all of the above to promote improved relationships and, hopefully, increased efficiency in these function's contributions to our nation's defense preparedness.

3. Approach: As customary, participants were encouraged to turn in written questions for discussion. Thirteen were submitted. In addition, invited short presentations on selected current vital issues were made by the following nationally recognized professionals:

Technology Transfer to a Dual Source	J. L. Remiker General Dynamics
Data Warranties	Al Signor NAVSEA Systems
Data Pricing	Ray Calhoun Texas Instruments
Data Manager Certification	Wally Rook* Cerberonics
DOD DM Media/Initiatives	James Richardson DMSSO

(*unable to attend - presentation made by substitute)

Interestingly, the thirteen submitted questions each fell into one of the above topics. The presentation and question/answer will be addressed together below.

4. Topics/Questions

   a. Technology Transfer to a Dual Source

   Q-l..."How much information is involved in the "why's" of the data package - - can you itemize the manufacturing information required?"

   Q-2..."Who is going to evaluate "proprietary rights" from the Government point of view? It would take a major retraining of DCAS personnel to permit them to do so."

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Q-3..."If Congress and DOD implement the proposed plan to obtain all manufacturing data as part of the reprocurement data package, will we not drive away many small business suppliers?"

Technology transfer is in essence a transfusion of information to a second source. In some respects it approximates what some in Government feel is required of a reprocurement data package - the second source needs to be able to duplicate the product using the same data package. This goes beyond the traditional Form, Fit or Function criteria. Also involved are the understanding of specification requirements, test requirements, factory processes - the whys and wherefores. This latter really becomes the essence of accomplishing a successful technology transfer to a dual source. The answer to who will evaluate "proprietary" (limited) rights is complex one and is being addressed in the new data initiatives. The Government expects that increasing second source procurement will broaden rather than decrease the small business base.

b. Data Warranties

Q-4..."(1) What specific things are warranted in a technical data package, i.e. format, fading, legibility, technical content, use by everyone? (2) Do you foresee a tie-in between hardware warranties and data warranties?"

Warranty of Technical Data was specified in ASPR 7-105.8(a) and made more specific in DAR 7-104.9, which inserted clauses in bas : regulation for firm-fixed price and fixed-price incentive contracts. FAR 46.701 thru 46.710 combines all types of warranties into one section of the regulation, defines warranties and nature and use of product.

DAR 7-104.9 states: Contractor warrants that all technical data furnished under the contract will at the time of delivery conform with the specifications and other requirements of the contract.

Warranty period - 3 years after completion of delivery, or at a greater time when specified in the contract.

Latent Defects - Defects discovered after delivery of data will be remedied by the Contractor.

Government may elect to:

(1) Have Contractor correct or replace , or

(2) Correct and realize an adjustment in price or fee

The matter of data warranties, including the extent and manner of assessing compliance is not throughly understood. It would be expected that (similar to the close tie-in of the procurement data package to the cost of spare parts) the application of performance warranties in DOD procured system/components would include both hardware and data. The extent and exact nature of tie-in are subject to question.

c. Data Pricing

> Q-5..."Our Program Office never uses the data prices we are required to prepare and submit - do you foresee the time when this information will not be required?"

Both Industry and Government representives complain about inconsistencies in data costs. The same requirements can result in "apparant" bid variations of twenty-to-one among offerers. Software costs offer similar frustrations. Yet, data has been estimated to be 30% of system acquisition cost, 60% of spares cost and 90% of R&D contract costs. It was reported that, per P.L. 96-511 requirements, the cost of data directly attributable to the DID's contained in the AMSDL is in the neighborhood of 137 billion man/hours. Variation in data costs are reported to result from differences in business procedures, differences in accounting systems, differences in preparation methods and others. The Data Price Group system further fosters inconsistency.

Basically, however, data costs are made up of a triad - Creation (cost of creating, generating, inventing and/or requiring information); Preparation (cost of preparing the data item, draft generation, editing, illustrating, keyboarding, proofreading, etc.); and Dissemination (cost of reproducing, distributing, maintaining, storing).

Again, the data price groups are subject to wide interpretation. But in all instances the basic cost has not changed; it still must be created, prepared and disseminated. The only thing that changes is how much of the cost is separately revealed.

No one is prepared to predict how long these inconsistencies will be continued.

d. Data Manager Certification

> Q-6..."What is (the) qualification to be certified as a Data Manager?"

> Q-7..."Are there sufficient people involved in Data Management to justify an organization devoted to Data Managers, hence DM Certification?"

> Q-8..."It was my understanding that those members present at (the) 1983 ADPA Technical Document meeting voted for certification and a definition was arrived at during the same meeting. The only problem remaining was affiliation. Is that not true and what are we doing or need to do?"

The stated concept was to develop a certification program for Government and Industry Data Managers (a) to promote the recognition of professionalism in the discipline (function) and (b) to attest to the qualifications and individual achievement through experience and the successful completion of a nationally recognized program.

One obstacle has been identifying a willing sponsor (organization) - still unachieved. Another problem emphasized at the 1983 Annual Meeting was an expressed need to standardize on the function definition before proceding further. A sub-committee was established and met later on in 1983 to address this problem but was unable to complete it.

Workshop participants expressed a fervent desire to continue to pursue this effort, recognizing that the function definition problem can readily be handled via a step-certification process similar to certifications in other fields. The announced decision to continue this sub-committee task requires the voluntary identification of interested active participants who will direct their efforts toward establishing specific criteria for certification. Some feel a DM/CM certification is perferred.

e. DOD DM Initiatives/Media

Q-9..."During the 1982 workshop it was indicated that Herb Atkins was in the process of developing a standard set of abbeviations for use on automated DD1423, or data tracking tools. I have been waiting two years for a report. What is the status of this effort?"

Q-10..."During 1982, I addressed a letter to DMSSO (Vince Mayolo). In the letter, I made a couple of possible recommendations to the DD1423. DMSSO responded that my comments were worthy of consideration and that an effort to review the DD1423 would take place in late 1982/early 1983. Did the meeting take place? What, if anything, resulted?"

Q-11..."I understand that EIA is in the process of developing a data management specification or standard. Would it be possible for ADPA and EIA to work together to develop the Industry data management specification or standard? Once developed, it could serve as the basis for a joint ADPA/EIA effort covering DM certification using the Industry DM specification or standard as the foundation."

Q-12..."Since there is no MIL-STD on Data Management, there has been difficulty in justifying the importance of the DM function; if technical manuals are removed from DM control is there any future for DM personnel?"

Q-13..."Explain the inconsistency in the Government documents - where DAR does not recognize "Proprietary Rights" but DODD 5400.7 does - for a wide variety of reasons."

The DOD near-term DM initiatives resulting from the new laws and DAR Supplement 6 (on Spares Procurement) are:

- Increased application of MIL-STD-789C, Procurement Coding, Spare Parts - - - Requires a detailed listing of each item of data
- Increased application of MIL-STD-885 Reprocurement Data Package - - -much greater emphasis
- Increased emphasis on contractor data management. More quality controls on accuracy and completeness of data package. More quality controls on application and working of Rights in Data. Availability of documentation to justify limited rights claims.
- From the above, expect Data Manager responsibility to increase dramatically

Fall-out from P.L. 96-511:

Need for media revision:

MIL-STD-963 (out this summer for review (comments))
DOD - 5010.12
DOD 5000.19L enclosure V
All Government agencies need to consolidate forms (e.g. 1423, 1664)
DD1423 revision March 1984 - late DID Data Base for all Federal Agencies?

Many report problems getting Data Manager into contract negotiations.

Feels that DM function won't really be impacted by taking Technical Manuals off of CDRL.

There is still time to make recommendations to DMSSO on improvements to DD1423.

EIA has been developing a DM Guide, but not issued yet. No precedence for but probably could be a joint issue if pursued.

With all the changes in media underway, some feel the need for some training effort (dog & pony show) to bring everyone up to speed. Suggestion that an overview of such and effort be provided at next year's annual meeting.

John R. Hart,
Chairman

ADPA MEETING ATTENDEE LIST
(Per Signup Sheet)

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A PEEK AT REASONS FOR INCONSISTENT DATA COSTS

Dr. Ray Calhoun
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SUMMARY

Both Government and industry complain about inconsistencies in data/documentation costs yet both share in a system which fosters inconsistencies. Both routinely engage in crusades to reduce the cost of "paper." Unfortunately, what emerges is a system (involving both Government and industry) that clouds rather than recognizes (or reduces) costs of information. Often, the data requirements are poorly defined. Even when given the same requirements, bidders responses exhibit wide variations. Some apparently "give away" data, while others are accused of "overpricing." Initially accurate estimates become changed and distorted during review, costing, and contracting processes. Because they are subject to wide interpretation, the four DoD data price groups foster inconsistencies. Inconsistencies also can occur because of Department of Defense policies which require line item costing also allow rolling up individual data item costs into program effort. By making data effort "part of the equipment (POE)" or Not Separately Priced (NSP)," data costs become obscured because they are incorporated into total program effort.

The key to consistency is to recognize that the basic cost of information does not change a great deal; what changes, under present practices, is how much of the cost is separately revealed.

Information (data) is a product. It takes many forms. The data effort represents a large (some say 30 percent or more) part of program costs and may be increasing because the ratio of software to hardware is changing. Software (which means more data effort) may soon exceed hardware costs.

Information is composed of the triad of creation, preparation, and dissemination. To reduce inconsistencies, we must develop a costing system to address all three facets of the information triad. Only then can we realistically approach the issue of data cost effectiveness.

A PEEK AT REASONS FOR INCONSISTENT DATA COSTS

Dr. Ray Calhoun
Texas Instruments

Both Government and Industry representatives complain about inconsistencies in data/documentation costs yet both share in the system which fosters inconsistencies. For example, an Electronic Industries Association study panel on data costs and data pricing noted that data pricing has long been a problem for both the contractor and the Government. The task of this panel (which included members representing both industry and Government) was to study the pricing issue and recommend a consistent approach to the pricing of data. An example they used was a matrix comparing the bid prices of five contractors (on the same proposed procurement) for five technical publications data items. Although the requirements were the same for all bidders, the responses ranged from a few thousand dollars to over two-hundred thousand dollars for the same item--over a twenty-to-one variation! After four days of work, panel members had identified some major factors affecting price inconsistencies. Among the possibilities considered were either to place creation costs into the data effort (together with the preparation and dissemination costs) or to place preparation and dissemination costs into Statement of Work (SOW) effort so that all three facets of the information cost triad could be considered. However, complexities of the issues were such that the panel members were unable to make any recommendations and they referred the problem back to EIA for further consideration.[1] The EIA panel's experiences offer but one example of the frustrations of trying to come to grips with the problems of data cost inconsistencies. Software data inconsistencies offer similar frustrations. Another EIA group, the subcommittee on Software Cost Estimating also addressed similar issues.[2]

Data, according to the Defense Acquisition Regulations (DAR) means: "Recorded information, regardless of form or characteristic," DAR 1-201.35. Some say we have been swamped by "paper" costs. Industry and Government managers find themselves ill-equipped to deal with paper. Parkinson wryly observes, "...paper has a tendency to breed and multiply."[3]

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[1]This group was empaneled at the 16th Annual Workshop of the G-33 Committee on Computer Resources, Data Management, and Configuration Management (EIA) held 20-24 September 1982, Dallas, Texas.

[2] The Software Cost Estimating subcommittee is a working group of the 17th Annual Workshop of the G33 Comitee on Data and Configuration Management and the G34 Committee on Computer Resources (EIA) which met 19-23 September 1983, Phoeniz, Arizona.

[3] C. Northcote Parkinson, "Parkinson on Paperwork," Modern Management: Issues and Ideas, ed. David R. Hampton (Belmont, CA.: Dickenson Publishing Company, Inc., 1969), p. 218.

According to Feeley, "The chief problem with data pricing today is the lack of interest and knowledge of data on the part of most Government Contracting Officers."[4] Industry program managers also appear to suffer from the same problem - lack of interest and knowledge. "Paper" is often viewed as a program manager's nemesis; a problem at worst, a nuisance at best.

A challenge faces both contractors and Government procuring activities to acquire the needed data without it appearing that "all that money" is being spent for "paperwork." Accordingly, inconsistencies develop. By making data effort "part of the equipment (POE)" or Not Separately Priced (NSP)," data costs are rolled up into total program effort which makes inconsistencies more difficult to see. Several reasons influencing inconsistencies come to mind.

(1) Dislike for paperwork stemming from the undesirable connotation given by our society.

(2) Policies - unofficial and official.

(3) Budget and/or organizational pressures.

(4) Designers that do not wish to be bothered by paper.

(5) Being unable or unwilling to discretely define the "data" in a way that can be costed. Or, parenthetically, unable to do anything with the unfortunate (albeit well-intentioned) definition of the data which is to be costed.

(6) An educational system that too often foregoes communications skills training and thus produces individuals that are ill prepared to deal with the documentation aspects of real-world programs.

(7) A negotiating tactic whereby the objective is to induce discussion over data items, thereby lessening attention to other items.

(8) A contractor marketing tactic where data is offered as a "lagniappe."

What are some official explanations of causes of inconsistencies? Clause DAR 3.814(b) lists the following causes.

(i) Differences in business practices in competitive situations
(ii) Differences in accounting systems among offerers
(iii) Use of factors or rates on some portion of the data
(iv) Application of common effort to two or more data items
(v) Differences in data preparation methods among offerers.

Another factor fostering inconsistencies is the "over and above" concept embodied in the four data price groups, which are subject to widely varying interpretations. Hence, use of the Department of Defense (DoD) price groups can foster cost inconsistencies. The question isn't one of do we want to know the cost of data, but rather one of how much, if any, of the cost of data do we wish to show?

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[4]Charles R. Feeley, The Vital Link: Understanding Contractor Acquired Data, (Charles R. Feeley, 1981), p. 7-15.

Three major areas form the data cost triad:

(1) Cost of creating, generating, inventing, and/or acquiring information.

(2) Cost of preparing the data item, such as draft generation, editing, keyboarding, illustrating, proofreading, etc.

(3) Cost of reproducing, distributing, and preserving the data item.

Additionally, the cost of maintaining and updating data items may be considered. Verification and validation costs also may impact some items. However, the three primary areas are creation, preparation, and dissemination.

With a Group I data item (an item prepared only because of user requirements), we may see all three major costs (creation, preparation, and reproduction/distribution). With a Group II data item (an item that requires additional effort to meet user requirements), we may see only the cost of preparation and reproduction/distribution. With a Group III data item (where the data exists but the item must be copied) we supposedly see only reproduction/distribution costs. Group IV data items (those prepared in the regular course of a commercial venture) are supplied at no charge; but they cost - nothing is free.

The data price groups are subject to wide interpretation, but in all instances the basic cost of information has not changed; it still must be created, prepared, and disseminated. The only thing that changes is how much of the cost is separately revealed.

No-cost or low-cost data appears highly desirable. Cost reduction is considered desirable, but one must remember that when cost truly is reduced to zero, no work is performed. The cost of information produced in the ordinary operations of an entity (which under the present over and above DoD guidelines would be Group IV data) ultimately is borne by the user just the same as the cost of a Group I data item is borne by the user. In the first instance, the cost is incorporated into the expenses of the entity and is factored into the cost of whatever goods or services the entity produces. In the second instance, the cost is separately identified.

Some among us say that cost consistency equates with cost savings. This is not necessarily so because consistency in costing does not mean lower (or higher) costs; it only means that costs are identified and presented similarly. For example, perhaps because of policy influences, lack of knowledge or interest, procuring activity strategy, or as a marketing tactic, some contractors appear to "give away" the data, a practice which fosters inconsistencies. However, the total program cost may be realistic because the bottom line question of, "Can I do this job (including the data) for this much?" must be answered.

Some have said that even with all of the data costing inconsistencies, data costs are small when compared to other program costs. Once this might have been true. Presently, if one could see through the veil of inconsistency and speculate on real costs, a hypothesis that information costs represent some 10 to 30 percent of total project value seems supportable. Feeley claims, "...the

data 'bite' has grown to up to 30 percent of total RDT&E costs."[5] According to Walton: "More than half of every dollar spent in research and development is expended for data efforts of researching, writing, reading, listening, talking, and processing records."[6] Percentages can be misleading in terms of dollars. A 50 percent data cost on a $100,000 Research and Development (R & D) study program would be $50,000, still a relatively small dollar cost. A 10 percent data cost on a $100,000,000 production procurement would be $10,000,000 - an amount that represents a significant sum although the data percentage is modest. The present estimate of data as 10 to 30 percent of contract value may be a increasing because the ratio of software to hardware is changing. Software development and maintenance costs are representing a larger portion of total project costs than in times past (and ratio of software to hardware continues to increase). Sue Segelke presents charts showing the ratio of hardware to software costs and DoD hardware/software cost trends that indicate software costs may soon exceed hardware costs.[7] Rather than face the costs of developing new systems, new applications for existing systems are being developed through software. Changing needs can be addressed through new software rather than new hardware. More software means more data effort. If data costs are considered to be the cost of information a new view emerges. Information is the product being procured and it still may be a bargain.

Another view is expressed by Vince Mayolo, formerly of the Defense Material Specifications and Standards Office (DMSSO), who claims that the real cost drivers are the requirements which cause data items to be generated. By carefully defining the requirements, data costs, in turn, can be influenced. Others say that some data items (for example, instruction manuals) create their own requirements because such items are needed to operate and maintain equipment regardless of the type of equipment being procured. However, no matter what position is taken regarding cost drivers, inconsistencies magnify cost differences. Another point, often overlooked, is that acquisition costs represent only some 25 percent of the cost to the user over the life of the item; some 75 percent of cost is incurred after the user receives the item (a lesson in life-cycle costs often not noticed by contractors). Standardization becomes important when viewing procurements over the long term. In the short term, consistency begins with the procurement/estimating/costing process.

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[5] Feeley, The Vital Link, p. 7-16.

[6] Thomas F. Walton, Communications and Data Management (New York: John Wiley & Sons, 1976), p. 19.

[7] Sue Segelke, "Ada: An Investment in the Future," pp. 30-35, Figures 1, 2, and 3, EG Engineering Journal, September-October 1983, Texas Instruments Incorporated, Dallas, Texas.

Dunn (1967) foresaw some of the underlying factors affecting data costs.

> An exponential increase in the amount and complexity of data. Tremendous advances in information and storage techniques. A gradual change in the nature of information presentation as we move from hard-copy data to machine processing.[8]

The magnitude of the task imposed upon data is great. There is nothing new about this situation either; Connell (1967) observed:

> Equipment has been drastically reduced in size while the amount of supporting data has remained about the same, depending upon maintenance concepts, and the reporting and control documentation has increased in volume and complexity. Complexity and function, not size or packaging, are determining factors. Size and packaging comparisons have caused data to be accused of not keeping pace with advances in equipment. This is part of the erroneous picture of data. Remember, data is the link between man and equipment and advancing equipment without advancing man only increases the magnitude of the task imposed on data.[9]

John R. Hart looks at data sacred cows and notes five contributing factors: (a) much too much data, (b) the expensive delivery system, (c) cumbersome requirements definition, (d) costly contract rigidity, and (e) ineffective management controls."[10] For example, Hart says that commercial purchasers of aircraft spend much less for documentation than military purchasers of the same type of aircraft. He asks, "Why doesn't the commercial world require all that data? The commercial world buys the best product at the best price, with the best service..."[11] He says that this extra body of data does nothing toward obtaining a better product, nor causing the product to be built cheaper or sooner.

INFORMATION is what is procured, not "paper." ANY INFORMATION IN ANY MEDIA becomes the primary concept. The computer revolution may well cause much "paper" to become obsolete. The centuries-old use of paper as a medium to store and exchange information is being challenged by the use of other (primarily electronic) media to handle information. Page counts can be misleading.

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[8]Don W. Dunn, "Lessons Learned from Apollo Data Management Programs," p. 6, Proceedings, 14th International Technical Communications Conference, Chicago, May 24-27, 1967, Society of Technical Writers and Publishers, (now the Society for Technical Communication).

[9]A. D. Connell, "Management of Subcontractor Data in the Systems Engineering Process," Proceedings, 14th International Technical Communications Conference, Chicago, May 24-27, 1967, Society of Technical Writers and Publishers, (now Society for Technical Communication), p. 4.

[10]John R. Hart, "Continuing Data Management Excess (or Feeding the Hungry Sacred Cows)" Proceedings, Twenty-Fourth Annual Meeting, 24-27 May 1982, Technical Documentation Division, American Defense Preparedness Association, San Diego, CA. (Washington, D.C.: ADPA 1982), p. I-1.

[11]Ibid, p. I-3.

Too often we have tended to concentrate on the cost of the page rather than the cost on information contained on the page

The cost of developing information is much greater than the cost of dissemination. The writer's empirical formula states that 50 percent of the cost is involved in developing information, 25 percent in preparing information, and 25 percent in reproducing/distributing information. Feeley says that Government interpretations of 70-80 percent for information development [which includes preparation effort], and 20-30 percent for reproduction/distribution are common.[12]

Now that we have said that INFORMATION is what is being procured and we have discussed reasons for inconsistency, what can be done to enhance cost consistency? The following considerations help develop cost consistency.

(1) Consistency begins with the procurement package. A well-developed procurement package makes estimating easier even with the costing system inconsistencies.

(2) Believe your estimate. We are excellent estimators but poor believers. It's a painful cliche' to say that we cut the estimate by an amount that eventually turns out to be an overrun or writeoff.

(3) Strive for internal consistency. If separate organizational entities of a company bid different portions of a procurement (such as one bidding a radar and another an electro-optical viewing set) which are part of the same weapons system (and each subsystem has a similar contractor data requirements list), the cognizant data estimators should coordinate and communicate enough to take similar approaches to the CDRL so that the data responses at least look like they came from the same company.

(4) Avoid the pitfall of the "free" typist (or free anything). It goes this way. If I have my document keyboarded by a secretary (who is indirect and doesn't charge effort to my data cost account) it costs me nothing. However, because effort is expended a cost is incurred. Somewhere the system must account for the effort (which can affect overhead). A similar cost myth for Government data managers is requesting items via the Data Accession List to avoid paying for information which might be the case if the information were acquired through a data item listing on the Contract Data Requirements List.

(5) Yardstick data costs with measures other than dollars. For instance, one can yardstick time, either labor time or machine time. Rates may vary and accounting systems may place effort in direct or indirect categories, but a time yardstick allows an estimate of the actual amount of effort and resources involved no matter what the accounting system.

(6) Be able to translate between the various systems of dollarizing used in industry and Government. The Government requires that costs be presented in a certain manner and many contractors use different estimating/accounting

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[12]Feeley, The Vital Link, p. 7-5.

procedures. Government estimating (for cost-type contracts) usually is based upon a treeing of costs (labor, material, overhead, general & administrative, CAS, etc.) and profit/fee. It's a very common practice for private industry to use markup pricing. The estimating system must be capable of converting from one format to the other. Ordinarily, the scope of work remains the same, but the formats change depending upon user requirements.

(7) Remember that you as a contractor data manager estimate the costs upon which future actions are based. Difficulties can be eased by a well documented estimate that fully addresses user requirements. Your estimate must be as accurate as possible to help make a winning proposal package.

(8) Use line item costing when developing your estimate. Even though the present system may subsequently induce distortions and inconsistencies, you have established a budgeting benchmark for future use. Contractors are required by Government to price data items one by one, ostensibly for cost visibility. Often, the data item prices subsequently are rolled up into a summed number for "data" which is shown as a contract line item (CLIN). In fact, DAR 3-814(d) requires that the tag end of the Contract Data Requirements List (DoD Form DD 1423), where individual data item prices are shown, not appear in contracts. Roll-up pricing can obscure data costs. Perhaps the popularity of roll-up pricing indicates the futility which exists in making any sense out of current data pricing practices. Furthermore, the Government benefits from CLIN pricing because the contractor must wait until all data items are completed before the CLIN can be billed (usually at the end of the contract). This is a good deal from the Government's view because the contractor must work on his own nickel before getting any return, especially if the data is not subject to progress payments. Another "gotcha" occurs even with line item pricing. The Government routinely imposes the Data Withhold clause, DAR 7-104.9(h), that reserves 10 percent of the total contract price until all data items are satisfactorily completed which means that funds equivalent to most (or all) of the data effort are not released until contract end. Accordingly, contractors attempt to reduce or eliminate this clause during negotiations.

(9) Find a better way of billing data items. Progress payments often are requested and used, but they may not include total payments for data items. The submittal of data items on a Letter of Transmittal (LT) with a summary DoD Form DD 250 (Material Inspection and Receiving Report) at the completion of the CLIN is another method of billing which is most cost-effective in today's system. But, no payment is received until CLIN completion. Submitting individually priced items with the DD 250 gets payment, but often the cost of processing the DD 250 is greater than the cost of the data item being shipped. If the user is willing to accept billing by commercial invoice, then the use of the DD 250 can be lessened.

(10) Check for cost consistency. If user requirements are accurately defined and understood, different estimators will arrive at similar efforts. The writer has participated in various cost-estimating exercises that have indicated that different data estimators arrive at similar figures given the same requirements. What happens is that these initial estimates subsequently become distorted and changed as they go through the review, pricing, and negotiating process. Various sources, both in Government and industry, show simi-

lar (although perhaps not real) effort amounts to prepare a page of a certain kind. We can ballpark the costs of preparing and disseminating a unit of information. Consistency in DoD price grouping (I, II, III, or IV) is necessary.

Once the cost of generation is included, the information cost triad is known. Even among different bidders, true costs for a unit of information probably are similar. Separately revealed information costs differ and result in inconsistencies.

The basic problem of cost consistency involves how much of the information iceberg is seen, not the size of the iceberg.

If our information costing systems can be adjusted to consider the cost triad associated with creation, preparation, and dissemination, we will have succeeded in reducing inconsistencies.

INFORMATION is our most valuable resource. The true cost of INFORMATION should be known. Both Government and industry spend a great deal on crusades to reduce the cost of "paper". Unfortunately, what has emerged is a system (involving both Government and industry) that clouds rather than recognizes (or reduces) costs.

The key to consistency is to recognize that the basic cost of information does not change a great deal; the only thing that changes, under present practices, is how much of the cost is separately revealed. Information (data) is a product. It takes many forms. The data effort represents a large (some say 30 percent or more) part of program costs. Because of growth of software, the data percentage is increasing. Information is composed of the triad of creation, preparation, and dissemination. To reduce the inconsistencies, we must develop a costing system to address all three facets of the information triad. Next, both contractors and procuring activities must similarly visualize the information triad. Only then can we realistically examine the issue of data cost effectiveness and achieve cost consistency.

A PEEK AT REASONS FOR INCONSISTENT DATA COSTS

by

Dr. Ray Calhoun

presented to

The 26th Annual Meeting of the Technical Documentation Division

AMERICAN DEFENSE PREPAREDNESS ASSOCIATION

San Antonio, Texas

May 1984

WHAT'S THE PROBLEM?

"THE CHIEF PROBLEM WITH DATA PRICING TODAY IS THE LACK OF INTEREST AND KNOWLEDGE OF DATA ON THE PART OF MOST GOVERNMENT CONTRACTING OFFICERS."

...Charles R. Feeley

PAPER IS VIEWED AS A PROGRAM MANAGER'S NEMESIS; A PROBLEM AT WORST, A NUISANCE AT BEST

DATA - WE APPEAR TO:

- OVERPRICE IT
- UNDERPRICE IT
- GIVE IT AWAY
- IGNORE IT
- ROLL IT UP AS "NOT SEPARATELY PRICED" OR "PART OF EQUIPMENT" TO HIDE IT
- TRY TO FORGET ABOUT IT

ALL OF US ARE A PART OF THE ACT

BOTH GOVERNMENT AND INDUSTRY REPRESENTATIVES COMPLAIN ABOUT INCONSISTENCIES IN DATA/DOCUMENTATION COSTS

BOTH SHARE IN A SYSTEM WHICH FOSTERS INCONSISTENCIES

THE SAME REQUIREMENTS CAN RESULT IN BID VARIATIONS OF TWENTY—TO—ONE AMONG OFFERERS

SOFTWARE DATA COSTS OFFER SIMILAR FRUSTRATIONS

SOME SAY WE HAVE BEEN SWAMPED BY PAPER COSTS

"PAPER HAS A TENDENCY TO BREED AND MULTIPLY." ...C. Northcote Parkinson

IMPACT OF DATA

30% OF SYSTEM ACQUISITION COST

60% OF SPARES COST

90% OF RESEARCH AND DEVELOPMENT CONTRACTS ...Charles R. Feeley

WHY DATA COSTS VARY (ACCORDING TO DoD)

DIFFERENCES IN BUSINESS PRACTICES IN COMPETITIVE SITUATIONS

DIFFERENCES IN ACCOUNTING SYSTEMS AMONG OFFERERS

USE OF FACTORS OR RATES ON SOME PORTION OF THE DATA

APPLICATION OF COMMON EFFORT TO TWO OR MORE DATA ITEMS

DIFFERENCES IN DATA PREPARATION METHODS AMONG OFFERERS

Clause DAR 3.814(b)

INTERPRETATION OF WHERE TO DIVIDE PREPARATION TASKS FROM PRODUCTION TASKS VARIES

CONTRACTOR DIVISION OF EFFORT	GOVERNMENT DIVISION OF EFFORT	COST TRIAD
CREATION TASKS	CREATION TASKS	CREATE
RESEARCH & ENGINEERING TO DEVELOP INPUT INFO., PRELIM. DRAFT	RESEARCH & ENGINEERING TO DEVELOP INPUT INFO., PRELIM. DRAFT	
PRODUCTION TASKS		
EDIT DRAFT ILLUSTRATE KEYBOARD, REVIEW, QA, FINAL PRINTOUT	EDIT DRAFT ILLUSTRATE KEYBOARD, REVIEW, QA, FINAL PRINTOUT	PREPARE
	PRODUCTION TASKS	DISSEMINATE
PRINTING DISTRIBUTION	PRINTING DISTRIBUTION	

EMPIRICAL REASONS FOR INCONSISTENT DATA COSTS

DISLIKE FOR PAPER STEMMING FROM UNDESIRABLE CONNOTATION GIVEN BY OUR SOCIETY

POLICIES - OFFICIAL AND UNOFFICIAL

BUDGET AND/OR ORGANIZATIONAL PRESSURES

DESIGNERS THAT DO NOT WISH TO BE BOTHERED BY PAPER

UNABLE OR UNWILLING TO DISCRETELY DEFINE DATA IN A WAY THAT CAN BE COSTED OR UNABLE TO DO ANYTHING WITH THE UNFORTUNATE (ALBEIT WELL INTENTIONED) DEFINITION OF DATA

EDUCATIONAL SYSTEM THAT TOO OFTEN FOREGOES COMMUNICATIONS SKILL TRAINING AND THUS PRODUCES INDIVIDUALS THAT ARE ILL PREPARED TO DEAL WITH DOCUMENTATION ASPECTS OF REAL—WORLD PROGRAMS

NEGOTIATING TACTIC WHERE OBJECTIVE IS TO INDUCE DISCUSSION OVER DATA ITEMS THEREBY LESSENING ATTENTION TO OTHER ITEMS

CONTRACTOR MARKETING TACTIC WHERE DATA IS OFFERED AS A ''LAGNIAPPE''

WIDELY VARYING INTERPRETATIONS OF THE FOUR DATA PRICE GROUPS

INFORMATION COST TRIAD

1. CREATION

    COST OF CREATING, GENERATING, INVENTING, AND/OR ACQUIRING INFORMATION

2. PREPARATION

    COST OF PREPARING THE DATA ITEM, SUCH AS DRAFT GENERATION, EDITING, KEYBOARDING, ILLUSTRATING, PROOFREADING, ETC.

3. *DISSEMINATION*

    COST OF REPRODUCING, DISTRIBUTING, MAINTAINING, AND STORING INFORMATION

DATA — HOW MUCH OF THE INFORMATION ICEBERG SHOWS?

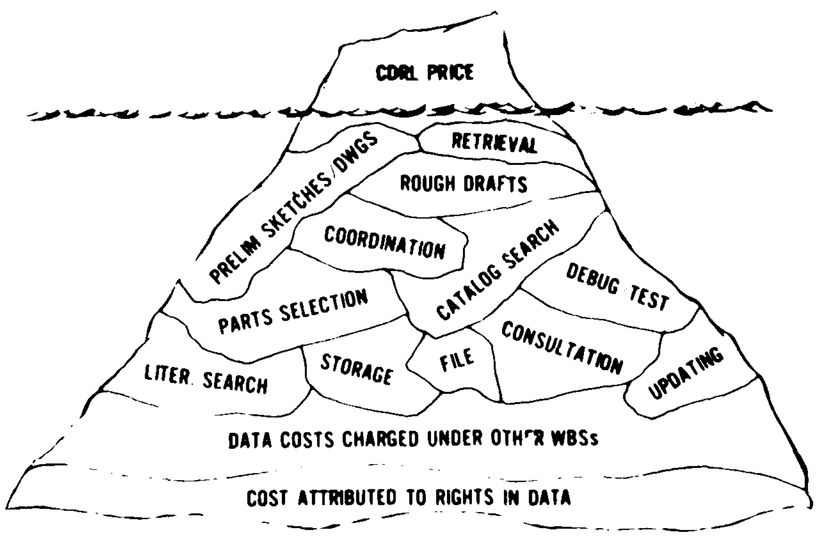
BASIC CREATION, PREPARATION, AND DISSEMINATION TASKS APPLY TO ALL INFORMATION

BASIC INFORMATION EFFORT DOES NOT CHANGE MUCH — THE TRIAD STILL APPLIES

INCONSISTENCIES OCCUR BECAUSE OF HOW MUCH OF THE TRIAD IS SHOWN WHERE

THE BOTTOM LINE MUST STILL INCLUDE THE DATA

REAL COST OF DATA



FEELEY
THE VITAL LINK

PRICE GROUPS FOSTER INCONSISTENCY

GROUP I	INCLUDES ALL THREE PORTIONS OF COST TRIAD
GROUP II	INCLUDES PREPARATION AND DISSEMINATION COSTS
GROUP III	INCLUDES DISSEMINATION COSTS ONLY
GROUP IV	NO CHARGE DATA

DATA PRICE GROUPS ARE SUBJECT TO WIDE INTERPRETATION

HOWEVER, IN ALL INSTANCES THE BASIC COST OF INFORMATION HAS NOT CHANGED; IT STILL MUST BE CREATED, PREPARED, AND DISSEMINATED WHETHER GROUP I OR IV.

WHAT ARE WE REALLY BUYING?

INFORMATION

INFORMATION IS WHAT IS PROCURED, NOT "PAPER"

ANY INFORMATION IN ANY MEDIA BECOMES THE PRIMARY CONCEPT

WE MUST CONCENTRATE ON THE COST OF INFORMATION CONTAINED ON THE PAGE NOT THE COST OF THE PAGE

INFORMATION REMAINS VITAL — PAGES MAY BECOME OBSOLETE AS CARRIERS OF INFORMATION

FACTORS FOSTERING CONSISTENCY

CONSISTENCY BEGINS WITH A GOOD PROCUREMENT PACKAGE

BELIEVE YOUR ESTIMATE

STRIVE FOR INTERNAL CONSISTENCY

AVOID THE PITFALL OF THE "FREE" TYPIST OR "FREE" ANYTHING

YARDSTICK DATA COSTS WITH MEASURES OTHER THAN DOLLARS (SUCH AS TIME, EITHER LABOR OR MACHINE)

BE ABLE TO TRANSLATE BETWEEN THE VARIOUS SYSTEMS OF DOLLARIZING USED IN INDUSTRY AND GOVERNMENT

DOCUMENT YOUR ESTIMATE

USE LINE ITEM COSTING WHEN DEVELOPING YOUR ESTIMATE

CHECK FOR COST CONSISTENCY AND INTERPRETATION OF DATA PRICE GROUPS

CONSIDER ALL THREE FACETS OF THE INFORMATION COST TRIAD

KEYS TO CONSISTENCY

RECOGNIZE THAT INFORMATION IS A MOST VALUABLE RESOURCE AND ITS TRUE COST *SHOULD* BE KNOWN

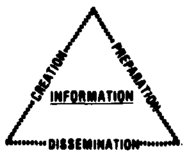
THE BASIC PROBLEM OF COST CONSISTENCY INVOLVES HOW MUCH OF THE INFORMATION ICEBERG IS SEEN, NOT THE SIZE OF THE ICEBERG

EVEN AMONG DIFFERENT BIDDERS, TRUE COSTS FOR A UNIT OF INFORMATION ARE PROBABLY SIMILAR

BOTH CONTRACTORS AND PROCURING ACTIVITIES MUST SIMILARLY VISUALIZE INFORMATION COSTS

BY CONSIDERING ALL THREE FACETS OF THE INFORMATION COST TRIAD (CREATION, PREPARATION, AND DISSEMINATION) COST CONSISTENCY CAN BE ACHIEVED

ONCE CONSISTENCY IS ACHIEVED, DATA COST EFFECTIVENESS CAN BE EXAMINED



WORKSHOP NO. 2

ENGINEERING DRAWINGS

Chairman:	Mrs. LORNA BURNS Corporate Manager Product Definition Standards Hughes Aircraft Company El Segundo, California
Panel Members:	Mr. CURTIS D. BAUER Chief, CAD Unit Aberdeen Proving Ground, Maryland
	Mr. CHARLES J. BORUM Configuration Management Office Redstone Arsenal Huntsville, Alabama
	Mr. LARRY A. CISKOWSKI, Supervisor, Drafting Standards Boeing Aircraft Company Seattle, Washington
	Mr. ALAN D. SIGNOR Engineering Configuration Mgmt Naval Sea Systems Command Port Hueneme, California
Recorder:	Mr. WALTER E. THIELE Chief Designer Delco Systems Operations Goleta, California

STATUS OF NATIONAL DRAFTING PRACTICES
(new/recently revised)

American Society of Mechanical Engineers (ASME)

Y14.5	Dimensioning and Tolerancing (Mr. Nicovich) - Revised 1982. The Subcommittee has resumed work on resolving the deferred comments and preparing the next revision (scheduled for 1987).
Y14.8	Casting and Forgings (Mr. Pickard) - Revision still in work. Plan to combine casting and forging (latter was formerly Y14.9)
Y14.13	Springs - New chairman needed.
Y14.15	Electrical and Electronic Diagrams (Mr. Muller) - IEEE has assumed responsibility for this standard; a new number will be assigned at the next revision. Only Logic Circuit Diagram Preparation is currently in work.
Y14.18	Drawings for Optical Parts (Mr. Beavers) - Public Review comments on proposed new standard currently being addressed by subcommittee. No DoD Acceptance Notice planned.
Y14.24	Types and Application of Engineering Drawings (Mrs. Burns) - Draft of proposed new standard transmitted to ASME for Y14 Standards Committee, DoD, and ANSI Public Reviews.
Y14.26	Computer Aided Preparation of Product Definition Data (Mr. Jones) - Standard issued 1981 is obsolete since it documents only Version 1 of IGES. Version 2 has been completed and Version 3 is eminent.
Y14.34	Parts Lists, Data Lists and Index Lists (Mr. Dubocq) - New standard issued 1982. No DoD Acceptance Notice.
Y14.35	Drawing Revisions - Public Review comments on the proposed new standard will be addressed when a new chairman has been established (one has been proposed).

Institute of Electrical and Electronic Engineers (IEEE)

ANSI/IEEE STD 91-1982, Logic Symbols (invoked by DOD-STD-100, Notice 3) - Not yet published. Copies of the draft approved by ANSI/BSR and sent for typesetting are available from Conrad Muller, IEEE (212/705-7960). (The Texas Instruments Data Handbook for Microcircuits contains a concise explanation of this symbology which is used in their handbook.)

IEEE STD 991, Logic Circuit Diagram Preparation - Public Review comments on proposed new standard are being addressed by the Coordinating Committee.

WORKSHOP NO. 2

ENGINEERING DRAWINGS

Attendees: 45 Industry
18 Government

A. SECTION ACTIVITY REPORT (L. Burns)

1. Joseph R. Meitz, Chairman of the Engineering Drawing Requirements Section (EDRS) for many years, has retired as of April 1984. He is in good health following last years cardiac surgery. Mr. Meitz will be missed.

Lorna Burns of Hughes Aircraft Company has been appointed by the TDD Executive Board as the new chairman. She welcomes your calls and expects that the drawing section will continue to serve both Industry and Government as it has in the past.

2. In recent months, the Section has reviewed and commented on the following draft proposals for new, revised, or reaffirmed ANSI standards. Letter Ballots have been submitted to the preparing organizations (ASME/IEEE) on behalf of ADPA as follows:

ANSI/ASME Y14.4, Pictorial Drawings - Approved with comments (4 pages)

ASME Y14.18, Optical Drawings - Approved with comments (14 pages)

IEEE-STD-991, Preparation of Logic Circuit Diagrams - Approved with comments (20 pages)

> NOTE: As a standards coordinating/approving organization only (ANSI does not develop any standards), ANSI no longer assigns unique ANSI numbers. Rather "ANSI/" is added as a prefix to the preparing organizations identifier when the document is approved as a national standard by the ANSI Board of Standards Review.

Review of draft proposals will be an ongoing activity within EDRS. Those who wish to participate in the review of such proposals were invited to join an active Review Group within the Section. The need for active, timely participation was emphasized. It is essential that comments are received by the specified due dates to permit consolidation in a timely manner. Late comments may be ignored by the preparing organization.

3. At the 1983 Annual Meeting, formation of an Ad Hoc Committee was proposed to investigate the impact of automation upon the drawing system and to identify the changes to existing specifications and standards needed to take full advantage of emerging technologies. This Ad Hoc Committee was officially established in March 1984. Larry A. Ciskowski of Boeing has volunteered to serve as chairman.

B. AD HOC COMMITTEE REPORT ON THE EFFECT OF AUTOMATION ON ENGINEERING DRAWING SYSTEMS (L.A. Ciskowski)

Mr. Ciskowski reassured attendees that there are no plans to disrupt the existing manual drawing systems; the manual drawing systems must be maintained for the foreseeable future.

To fully utilize automation, however, some significant changes will be required in DOD-D-1000, DOD-STD-100, and related industry standards. Typical changes include:

- Expanding the definition of drawing originals to include electronic data base forms.
- Making approval requirements compatible with automated methods.
- Revising drawing formats to be compatible with automated systems.
- Discarding obsolete originals when the original exists in electronic data base form.

The need for Industry to adopt and implement a standard neutral data base format, such as IGES, is recognized; not only at this workshop, but by several of the 1984 speakers and nationally.

The 3-D interactive graphics modeling systems may require a change to conventional 2-D drawing presentation techniques. The 3-D model may provide a configuration definition such that drawings as we know them today may not be required.

The committee will attempt to prepare a "white paper" in these areas. Anyone wanting to participate in this task should contact either Mr. Ciskowski or the Section Chairman.

Curtis Bauer of Aberden Proving Ground recommended that awareness of data set approval, data revision, acceptable electronics media configuration, and what constitutes master configuration, be ever in the contractors' consciousness.

C. QUESTIONS AND ANSWERS

1. Two controversial questions were asked that suggest that a need exists to rethink, very carefully, what information is specified on drawings. This is particularly critical in view of the Congressional interest in competitive reprocurement and spare parts cost-reduction. These questions are:

> 1Q - Should we minimize the use of company specifications and standards and maximize the use of military and industry specifications and standards?
>
> 1A - Of course.

This may seem like a strange question, particularly considering that it was submitted by a knowledgeable Air Force representative who is well aware of the order of precedence for selecting specifications and standards required by MIL-STD-143. This individual was making a point.

In practice, there is a wide-spread proliferation of unique company standards, even though the DOD Index of Specifications and Standards already lists equivalent specifications or standards. Often these unique standards are the result of a company (or even a military activity) establishing a level of detail (how-to instructions) beyond that necessary to ensure fit, form, and functional interchangeability of the product. There is a fine line between specifying complete requirements and over-specification which produces unrecognizable versions of standard requirements.

> 2Q - What part number control applies to a military specification part purchased with leads formed and tinned?
>
> 2A - Many at the workshop were quick to answer, "that's an altered item." But is it really?

MIL-STD-275 calls for lead forming requirements to be specified on the assembly drawing. In most cases, the advanced forming and tinning of leads is merely a convenience for manufacturing. Virtually any competent, trained person could install the MIL-spec part in the assembly--especially under wartime conditions. We should not complicate the Supply system by introducing: (1) unnecessary nonstandard part identification, and (2) the attendant delays which occur until someone finally figures out that it is really a standard part.

> RECOMMENDATION: Devote a workshop session at the 1985 Annual Meeting to exploring the impact of drawings on Supply.

2. The following additional questions were presented by the workshop attendees for response by the panel:

1Q - Does the EDRS plan to publish synopses of changes between old and new issues of standards?

1A - The ANSI Y14 series standards contain a description of the changes in the Foreword of the standard or in an historical appendix when the committee feels that such information is of value; therefore such synopses will be developed only when there is some unusual complexity or impact. (We, of course, need volunteers to do the work.)

2Q - Are there plans to allow part numbers in excess of 15 characters?

2A - No - It is explicitly controlled/limited to 15 characters.

NOTE: Arnold Batina of Ball Aerospace, Boulder, CO indicated he had heard here was a letter published by DMSSO which provided for special applications.

ACTION ITEM: L. Burns subsequently contacted DMSSO regarding the question. We have been assured that no such change has been approved; however there is a request from the Air Force.

3Q - When reidentifying military specification numbers greater than 15 characters (e.g. descriptive identifiers, type, class grade, etc) with a company control drawing, is a nonstandard part approval required?

3A - No--but to maximize useability of the engineering documentation, the identification control number should be treated as a reference number and the complete MIL-spec identification included in the Description field of the Parts List or in the Material block of the drawing.

4Q - What is the consensus of the group in applying the new ANSI Y14.5M-1982 dimensioning and tolerancing symbols in lieu of words?

4A - The intent of the symbols is to establish a universal (ISO) language for dimensioning and tolerancing. This minimizes the amount of translation of English vocabulary necessary when drawings are used Internationally. Very few of those present had implemented the symbols yet.

5Q - When an ANSI specification is referenced in notes on a drawing, must the date of the specification be included?

5A - ANSI specifications include the date as an integral part of the specification number. Yes, the date must be included (e.g.; ANSI Y14.5M-1982).

6Q - Relative to MIL-D-5480, Class 2 (reproducible), is the word "copy" to be interpreted as "reproducible" in defining a fourth generation print?

6A - Yes.

7Q - Relative to 6Q, does the fourth generation have to produce a legible copy?

7A - Yes, however the legibility of this fifth generation copy is a by-product of the fourth generation meeting the legibility requirements of MIL-D-5480.

8Q - Is MIL-D-5480 being revised? Where is "drawing copy" vs "non-drawing copy" defined?

ACTION ITEM: L. Burns will contact the Preparing Activity for further clarification.

9Q - When are we going to have an improved definition for specification control drawings?

9A - The Preparing Activity for DOD-STD-100 was given a proposed "Draft" to reidentify and clarify specification and source control drawings (Tech Report 25 June 1980) in which one recommendation is to change "Specification Control" to "Vendor Item" Drawing. There has been no formal response to this.

10Q - Who is/isn't labeling CAD generated drawings? and how?

10A - Attendees using CAD drawings fell into three groups:

a. Approximately half were not labeling CAD drawings.

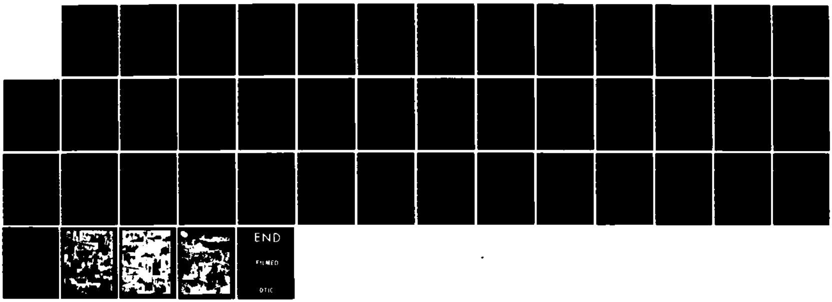
b. Approximately 25 percent label drawings with a tape (program) file number in the border of the drawing.

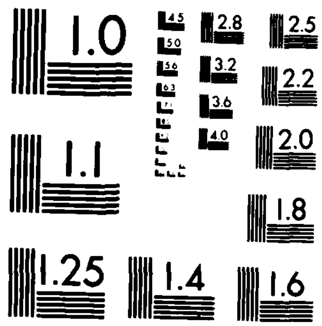
c. The remainder label their drawings above the title block with a notations such as "COMPUTER GENERATED DRAWING" and the file number.

It was the consensus of those present that inclusion of the data base file number on the field of the drawing tends to imply that the file is a part of the data package and, therefore, potentially deliverable. If such notation is needed for internal purposes only, it should be placed in the drawing border.

AD-A152 549 PROCEEDINGS OF THE ANNUAL MEETING (26TH) TECHNICAL DOCUMENTATION DIVISION..(U) AMERICAN DEFENSE PREPAREDNESS ASSOCIATION ARLINGTON VA 10 MAY 84 4/4

UNCLASSIFIED F/G 5/2 NL





MICROCOPY RESOLUTION TEST CHART
NATIONAL BUREAU OF STANDARDS-1963-A

11Q - When a drawing defines a "blown" PROM or EPROM, is the drawing an "Altered Item"? If the EPROM is erased and changed, is it still considered to be "Altered"?

11A - A blown PROM (or EPROM programmed as an individual part) is an altered item drawing. If an EPROM is programmed in its using assembly, any alteration or change to that program is a change to the using assembly part number.

12Q - What is the meaning of the signature in the approval block? Does it mean the drawing meets drafting standards, or is released, or design meets customer specification, or other?

12A - There is no government/industry standard that establishes uniform meaning. Individual company procedures generally define the criteria for such signatures. Typically, such signatures indicate that to the best of the signer's knowledge and responsibility, the drawing adequately and accurately describes the item such that it can be used for the intended purpose.

13Q - What is the status of the ANSI casting and forging drawing standard?

13A - Draft is still in ASME Y14.8/9 Subcommittee.

14Q - What Data Item Description is being used for the on-line engineering documentation being used for Pershing II that Charles J. Borum described in his presentation (see his paper in these proceedings)?

14A - DI-E-1101C supplemented by the Statement of Work which says that data supplied on-line need not be supplied in hardcopy form.

15Q - Can computer programs which are stored and released on electronic media (e.g., magnetic tape, punched tape, floppy disk, etc) be shipped as part of a data submittal package or do hardcopy "drawings" have be be made for these computer programs?

15A - This depends on your specific contractual requirements. Check the applicable CDRL and the Data Item Descriptions referenced therein.

16Q - Do drawings have to be signed or can we utilize an on-line sign-off method where each signature is typed?

16A - At this time, this is a gray area. A variety of methods are being used by various contractors including:

- A note on the drawing which refers to internal release records for approval signatures.
- Use of a light pen to sign on the "tube".
- Internal procedures that establish password control and identifying symbology.

Such procedures need to be documented and provide adequate control to ensure the integrity of the documentation.

> NOTE: When drawings are redrawn, prior approval signatures are generally printed; not re-signed. The approval signatures for the redraw are contained either in the Revision block of the drawing or in the change authorization document.

D. THANKS to the Panel members and Attendees for their active participation.

ENGINEERING DRAWINGS
WORKSHOP #2

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Ronald T. Nave	Emerson Elect Co, E&S Div 8100 W. Florissant St. Louis, MO 63136	(314)553-2788
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Richard P. Sanczel	Martin Marietta Corp Sand Lake Road Orland, FL 32802	(305)356-7111
Burt Schaefer	Pitney Bowes 380 Main Avenue Norwalk, CT 06856	(203)854-7117
Ray Schmitt	The Singer Company 150 Totowa Road Wayne, NJ 07470	
Edward R. Shoemaker, Jr.	Pratt & Whitney Aircraft P.O. Box 2691 M/S 709-64 West Palm Beach, FL 33402	(305)840-3579
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WORKSHOP #3

ILS/TECHNICAL PUBLICATIONS

MEETING REPORT

WORKSHOP PARAMETERS - The ILS/Technical Publications Workshop was conducted from 1315 to 1700 on May 8, 1984 in the Terrace Room of the El Tropicano Hotel, San Antonio, Texas. This workshop was a part of the Twenty-Sixth Annual Meeting of the Technical Documentation Division, American Defense Preparedness Association.

Workshop #3 was attended by 36 participants (8 government and 28 industry representatives). The roster identifies each participant by name and affiliation.

OVERVIEW - The Workshop Chairman convened the session by presenting a brief report on the status of last year's action items. Two areas of follow-up action were reported:

The first area involved assistance in the Technical Manuals Specifications and Standards (TMSS) program. The Program Plan for this effort was first approved in January, 1980 and revised in July, 1983. This plan was developed and coordinated with the DOD Components and Industry by the U.S. Army DARCOM Material Readiness Support Activity, Lexington, KY, the Lead Service Activity. The tasks identified in the plan have been approved by the Joint Logistic Commanders (JLCs). It was noted that the TMSS Chairman, Mr. Art Rulon of DARCOM, was to present a TMSS status report during Session III (May 9, 1984) of the 26th Annual Meeting (his presentation is included in the minutes of the General Membership Meeting). A copy of the latest (July 1983) TMSS Program Plan was available at the workshop session for reference. There is no publication number assigned to this document, but copies (no cost) are available under the title "Technical Manuals Specifications and Standards (TMSS) Program Plan" dated July, 1983 by writing to:

Naval Publications and Forms Center
5801 Tabor Avenue
Philadelphia, PA 19120
Attention: Customer Service - Code 1052
(Telephone (215) 697-2667)

Further action on TMSS tasks is anticipated, and 25 of the 28 industry participants indicated a desire to serve when TMSS industry coordination is requested.

The second area involved follow-up to the NAVSEA Modular Specification System (M-SPECS) that is now identified by the acronym TMARS (Technical Manual Acquisition Requirements System). A TMARS briefing was scheduled for Session III (May 9, 1984) of the 26th Annual Meeting but was cancelled at the 11th hour. In the Workshop #3 summary report to the general membership (Session V), comments were solicited from those having either favorable or unfavorable experience with the TMARS approach. It was requested that such comments be sent directly to:

Naval Sea Data Support Activity (NSDSA)
Naval Ship Weapon Systems Engineering Station (NSWSES)
Port Hueneme, CA 93043
Attention: L.R. Melton - Code 5730
(Telephone (805) 982-5093/4319)

Following the action item coverage, the Workshop Chairman briefed the participants on the ILS/Technical Publications issues that surfaced during the two Executive Board Meetings (Sept.'83 Meeting at the Boeing Kent Space Center, Kent, WA and Feb.'84 Meeting at the Defense Logistics Agency (DLA), Cameron Station, Alexandria, VA). Minutes of these Executive Board Meetings contain the details of these issues.

After the introductory report, the purpose and operating procedures for the workshop session were given. "Question/Problem" forms were made available to workshop participants and as a result of this solicitation, five workshop issues were identified for discussion. To prepare for the discussion, each participant was asked to identify individual background information such as name, affiliation, position, and brief sketch of applicable experience. The Workshop Chairman then stressed that each participant should contribute as an individual rather than as a representative of the affiliated company or military service. Using this approach, the workshop objective was established as the resolution of the "Question/Problem" issues that would best serve American Defense Preparedness.

WORKSHOP ISSUE 1 - STANDARD FOR DIGITAL DELIVERABLES

PROBLEM: Many companies have automated their technical publications preparation functions. DOD agencies such as the Air Force with ATOS are moving into automation and indicate they will require a digital deliverable. DOD must develop a standard or specification up front to define that digital deliverable. Without that spec or standard, the systems developed by contractors may become obsolete when DOD decides to develop this spec or standard.

DISCUSSION HIGHLIGHTS: Reference was made to the Task 4 effort of the TMSS Program Plan (July 1983). The title of this task is "Investigate the Development, Implementation and Impact of Electronic (Digital) Delivery of Technical Information to the Service Operators and Maintainers as a Substitute or Supplement to Hard Copy Technical Manuals." Under the Task 4 scope, system examples are identified by the acronyms ATOS, PEAM,NTIPS, TICCIT, NOMAD. One objective of Task 4 is to assess the need for management control in the introduction of the technology and for specifications and standards for the hardware and software systems involved. This segment of the discussion stressed the awareness and attention this problem is being given in the TMSS effort.

Another segment of the discussion involved current attempts to establish a standard applicable to the interchange of information among remote locations, using a variety of input and output devices and processing systems. Reference was made to Standard 101-1983 from the Graphics Communications Association adopted by the Department of Defense on 10 August 1983. This standard implements the Document Markup Metalanguage "GENCODE" and the Standard Generalized Markup Language (SGML). Reference was made to the Proceedings

of the 24th Annual Meeting of the Technical Documentation Division (San Diego, CA on 24-27 May 1982). Both the presentation by Richard C. Sisman on "Generic Text Coding" and the Workshop #3 ILS/Technical Publications Meeting Report were cited. Those wishing to obtain a copy of Standard 101-1983 should contact the following for price and ordering information:

Graphic Communications Association
1730 North Lynn Street/Suite 604
Arlington, VA 22209
(Telephone (703) 841-8160)

The discussion stressed the need for timely release of interface specifications and/or standards to define digital deliverables but recognized the sizeable coordination effort required to accomplish this. Much of the urgency could be relieved if the standard followed the Gencode type of approach which allows for a variety of input and output devices and processing systems.

RESOLUTION: Continue to keep informed of progress on the TMSS Task 4 mission. Provide assistance as requested to support this effort. Continue to monitor developments in the Gencode, optical disc and video disc areas.

WORKSHOP ISSUE 2 - TECHNICAL DATA COSTING

QUESTION: What is the most effective way to accurately assess the cost of tech data (SPTD, PPL, Illustrations, etc.)? Since one contractor uses engineers to complete most of the data and another uses engineering technicians, etc.

DISCUSSION HIGHLIGHTS: To accurately assess the cost of technical data, the evaluator must recognize that under the free enterprise system, industry is not restricted to a single modus operandi or accounting system. This makes across the board evaluations more difficult (if not meaningless) but does encourage innovation and creativity in problem solving. Many variables

were discussed such as degree of automation, use of indirect versus direct resources, allocation of costs to common use effort, type of personnel assigned. Within any single organization, the accurate assessment is made because the variables are fixed for that organization. For meaningful evaluations, the backgrounds and approaches of the different organizations must first be determined before attempting comparison. Reference was made to a recent presentation made by Mr. C. Ayres of the DARCOM Material Readiness Support Activity entitled "Technical Manual Cost and Volume Study" dated July 1983.

RESOLUTION: Recognizing that comparison of apples and oranges will bear fruitless results, evaluators must first identify the variables, determine the individual approaches taken, and then review individual histories to accurately assess technical data costing.

WORKSHOP ISSUE 3 - GUIDELINES FOR TECHNICAL MANUALS

PROBLEM: We had trouble finding the exact guidelines on:

- Specific illustration requirements (when to phantom, call out all parts, etc.)
- Error rates for Service TM's, Parts TM's DEP VS.FDEP

It ended up that we received written "direction". We are concerned however that the "direction" is based strictly on local interpretation of loosely worded standards.

DISCUSSION HIGHLIGHTS: During the discussion it was determined that this problem was submitted by a participant who has not had much past dealings with DOD technical manual requirements. Attention to contractual requirements was stressed as well as the intent of loosely worded standards. The prime obligation is to the user to insure good communication of operating and maintenance techniques that will reflect the design parameters. Guidelines that are too narrow in scope restrict your flexibility in meeting your prime objective.

RESOLUTION: Attempt to pattern your approach to the user. This can best be accomplished by working through your government counterparts since they have the same prime objective. The success of your approach will be measured during the verification procedure.

WORKSHOP ISSUE 4 - DID MODIFICATION

QUESTION: Is there any effort being taken to prevent the specifying activities, when writing IFBs/RFPs, from modifying DIDs indiscriminately, causing industry to continuously rethink at the bid stage?

DISCUSSION HIGHLIGHTS: Reference was made to TMSS Task 2 (Development of DID Tailoring Procedures and Consolidation of existing DIDs) and Task 3 (Analyze DODISS and non-DODISS TMSS Documents and Related DIDs to identify Overlap and Duplication with Potential for Consolidation and/or Cancellation). These high priority TMSS tasks indicate the stress that DOD is putting on reducing and managing the DIDs. The possibility of acquiring Technical Manuals as contract line items is also being considered which would remove them from the CDRL and DID approach.

RESOLUTION: The problem is well recognized by DOD and steps are underway to improve the use of DIDs as a management acquisition tool. Consolidation is the objective not expansion or large scale modification.

WORKSHOP ISSUE 5 - TECHNICAL INFORMATION MANAGEMENT SYSTEM

QUESTION: Is there anyone looking at a Technical Information Management (TIMS-Army) approach - a systems architecture/standard for integration of CAPS/LSAR/CM/CAD-CAM?

DISCUSSION HIGHLIGHTS: This question was in follow-up to a TIMS presentation given by Col. Mark Reese at a recent NSIA ILS meeting. The management system was presented as a womb to tomb concept

Jim Richardson indicated that this matter was tasked to Defense Information Analysis (DIA) for consideration.

RESOLUTION: Considering the impact of such a system, progress on the TIMS approach will be given appropriate follow-up.

RECOGNITION: Special thanks are in order for the excellent setting provided by the El Tropicano Hotel.

Also, the attendance and active participation of Jim Richardson and Burt Newlin did much to achieve the communication level that was realized. Although not established as a formal panel, these participants formed the backbone of the workshop session. The entire session was devoted to issues brought up by the participants. The three key areas of concern prepared by the Workshop Chairman were not addressed due to lack of time. These issues have been tabled till the 27th Annual Meeting.

WORKSHOP #3

ILS/TECHNICAL PUBLICATIONS

ROSTER

NAME	AFFILIATION
Richard E. Knob	Sperry Corporation
John Curtin	Kollsman Inst. Co.
Al Ebeling	ABA Industries
John P. Campbell	BMAC Wichita
Alan Johnson	BCS Wichita
Burt Newlin	DMSSO
Earnest W. Deadwyler	Texas Instruments
Warren Knutson	Pacific Car & Foundry Co.
Richard Robinson	Pacific Car & Foundry Co.
R. G. Sarkies	Boeing Aerospace Co.
Mario Ramirez	Hq. AFALC/PTJ
Susano Mascorro	ASD/YZF WPAFB, OH.
Alfred White	ARINC Research Inc. San Diego
Lamar Williams	Newport News Shipbuilding
Angelo Christiano	ORI, Inc.
Ralph P. Brown	XMCO Inc.
David A. Patterson	Chevrolet Motor Div.
Garth H. Payne, Jr.	FMC, Inc.
Carl D. Krebs	AT&T/Doc.Dev.Org.
Ray Nichols	AT&T Technologies - Fed.Sys.Div.
Vernon Bednard	TACOM, Warren MI.
Linus Glowienka	Ken Cook Co.
Leon Snodgrass	EG&G Washington Analytical Services
Francis R. Sullivan	Ford Aerospace, Colorado Springs
Robert B. Quillen	Honeywell - Clearwater, FL
Clifford G. Wayne	Electronic & Support Services, Inc.
Ivan L. Bengtson	National Security Agency (NSA)
Kenneth L. Dion	General Dynamics Land Systems
Carles A. Miller	Finkelstein Associates, Inc.

NAME	AFFILIATION
Gene Wright	TPC Logistics Services Inc.
John Scotton	USA CECOM Pt. Monmouth (DME)
Richard H. Suskind	Lockheed (LAD)
Jack Hamilton	Raytheon MSD/ILS
Emmett Boyd	Litton Systems Inc.
Edward McIntyre	National Security Agency (NSA)
Jim Richardson	DMSSO

AGENDA

Workshop #4
Configuration Management
Wednesday, May 9, 1984 - 1315 Hours

CHAIRMAN:

Mr. Charles J. Embrey
MITRE Corporation (W458)
1820 Dolley Madison Blvd.
McLean, VA 22102
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PANEL MEMBERS:

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Mr. James Remiker
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TELEPHONE: 619-573-8588

Mr. Michael Long
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7700 Arlington Blvd.
Falls Church, VA 22046
TELEPHONE: 703-560-5000 X2885

SUBJECTS:

1. HR 5064
   "Defense Spare Parts Procurement Reform Act"
   Sponsor - Congressman Nichols (D), Alabama

2. Professional Certification for Configuration Management Personnel

3. Questions/Discussions Posed by the Workshop Attendees

4. Development of an Action Item List for Unanswered/ Unresolved Items to be Worked On During the Coming Year.

WORKSHOP PURPOSE:

The purpose of the Configuration Management Workshop was to utilize the knowledge gained by the government and industry participants who work with and apply this management discipline on a day-to-day basis, and also improve communications regarding CM matters between all of the attendees. The objective of the workshop was to identify and resolve problems which are currently being experienced by the attendees, through questions and answers posed by both the panel and the attendees. Those problems which required specification changes to resolve, or were otherwise too time-consuming or complex to resolve at the workshop, were recorded as action items and will be addressed by the CM committee during the coming year.

WORKSHOP SUMMARY:

Mr. Charles Embrey opened the workshop and introduced the panel members. The workshop attendees were provided with copies of the proposed H.R. 5064, Subject: "Defense Spare Parts Procurement Reform Act," on Tuesday, May 8. There were a number of questions concerning that proposed bill which were previously written and submitted to the Chairman. Those questions, plus comments and questions from the attendees during the course of the workshop on HR 5064, the certification of CM personnel, and CM-related topics, formed the basis of the workshop's activities.

Mr. James Richardson, Staff Director, Technical Data Division, Defense Material Specifications and Standards Office, addressed the subject of HR 5064 on Tuesday, May 8, which provided the workshop attendees with a general overview of that bill and 85 similar bills concerning spare parts procurement currently in process within Congress.

HR 5064:

1. General comment - The proposed bill was too lengthy and detailed to discuss in its entirety during the course of one workshop.
2. Specific Questions/Comments:
   a. Who has design responsibility for spare parts? The DAR Supplement No. 6 of Jun 83 defines "Actual Manufacturers," and the FAR has incorporated Sup. #6 in total.

b. It was noted by a number of the attendees that the proposed bill is a "shot gun approach" to resolving the spare part procurement problems, and the subject of "multi-year parts buy" was not adequately addressed by the bill.

c. The workshop attendees were in general agreement that the replenishment of spares does drive the cost of spares up when those procurements are made by individual FY. Determination of spares requirements should be made for program out-years, in the early stages of the acquisition process.

d. It was also noted that the government procurement activities are concerned with economical spares replenishment, but manufacturers currently require that large quantities be procured to effect a cost savings per unit procured.

e. The workshop attendees discussed the following specific section of the proposed bill at length.

(1) Pages 8 and 9

" Para 2386a. Rights in technical data and computer software

"(a) A contract for supplies entered into by the Department of Defense which provides for delivery of technical data or computer software to the United States shall provide that the United States shall have unlimited rights in --

"(4) technical data necessary to enable manufacture of end-items, components, and modifications, or to enable the performance of processes, when the end-items, components,

modifications or processes have been, or are being, developed under a Government contract or subcontract in which experimental, developmental, or research work is or was specified as an element of contract performance, except technical data pertaining to items, components, processes, or computer software developed at private expense;

(2) Page 11

"(2) Each contract described in paragraph (1) shall provide that if--

"(A) the contractor asserts that the United States is not entitled to unlimited rights in technical data relating to an item, component, or process; and

"(B) the assertion is not sustained and it is determined that the assertion was not substantially justified,

the contractor shall be required to pay to the United States the costs to the United States of contesting the assertion."

f. It was suggested by the attendees that the terms, "Developed at Private Expense, Manufacturing Data, and Data Management Subsystems" be further defined as used in the proposed bill.

g. General conclusions reached by the attendees on HR 5064 were:

(1) HR 5064 appears to be redundant of existing regulations, provides no apparent additional benefits and adds significant costs to the acquisition system. Such suggestions as the "personnel appraisal system" which shall be established encourages costly "witch hunts" to realize some unknown reward.

(2) Other regulations included in this Bill are establishing requirements contrary to currently operating procedures and should be eliminated or fully coordinated prior to acceptance.

(3) It is suggested that this Bill be tabled until appropriate hearings can be held.

ACTION:

C. Embrey to forward a copy of this discussion and workshop conclusion to Congressman Nichols' office for his consideration.

PROFESSIONAL CERTIFICATION FOR CM PERSONNEL:

1. The attendees discussed the possibility of establishing an ADPA sanctioned CM certification program for CM personnel. That discussion centered on the following key points/questions:

a. Will certification prove to be beneficial?

b. Should hardware CM be separated from Software CM in the certification process?

c. Should a series of certificates be established to indicate progression from the technician level to a high level professional?

d. Should a "Grandfather clause" be invoked for current CM professionals with X number of years experience?

e. Who will establish certification criteria, and by what authority?

2. It was agreed by the attendees that a working group should be established to develop a "strawman" certification policy and procedures document, to be presented at the next workshop for further discussion. C. Embrey agreed to chair that working group, which will be composed of the following individuals:

Joseph J. Adamo	108 Wimberly Rochester, MI 98064
Mike Daniels	The MITRE Corporation 1820 Dolley Madison Blvd. McLean, VA 22102
Tony Darmanin	General Motors of Canada Ltd. Diesel Division P.O. Box 5160 London, Ontario N6A4N5 (519) 452-5533
Dick Mooney	Control Data Corporation 3101 E. 80th Box 609 Minneapolis, Minnesota 55440
Dick Thomas	FMC Corporation 1105 Coleman Ave. San Jose, CA (408) 289-3973
Julie Thomas	TRW 7600 Colshire Dr. Fairfax, Va. 22102 W1/3530

QUESTIONS/DISCUSSIONS
POSED BY THE ATTENDEES:

1. For proposal response, is Data Management considered part of CM? Also, is it possible to have standardized CM or DM wording, or does each response require complete or special wording?

   - A possible solution to proposal responses is to cite in-house (company) CM&DM Standards and Procedures. It should be noted that ADPA is currently promoting Government certifi ation of Contractors in-house CM&DM plans.

2. Is there a CM status accounting computer program available for an IBM PC that will handle 100-300 drawing end items of 1-10 quantity? Can a copy be purchased?

   - Suggestion was to develop your own software using DB-II or R-Base.

3. Are any aerospace contractors having problems in contract closeout/fee negotiations with the number of waivers/deviations processed under MIL-STD-480A?

   - If the contracting officer has signed the waiver, and the deviations are approved by the procuring activity prior to production, there should be no problems.

4. What software/hardware components does the DOD define as "firmware"? If "firmware" is truly defined, are there any specific DOD-STDs or specs relating to the documentation of firmware?

- MIL-STD-SDS (proposed) of 31 August 1983, Subject: Defense System Software Development defines firmware and how it should be documented. That standard is scheduled for implementation in October 1984.

5. One Ada goal is to encourage reusable software modules. Is an effort underway or planned to implement a software equivalent of "standard parts" and "federal stock number" schemes? Who is doing so?

   - No one is working directly on this problem. The Government is moving to defined modules, and there is an Ada newsletter which will address the problem in the near future.

ACTION ITEM LIST:

1. Mr. C. J. Embrey will supply updated/new DOD CM documents to the workshop attendees for comment as they become available.
2. Mr. C. J. Embrey and the CM Certification Working Group will draft a "strawman" CM certification policy and procedures document for presentation at the next CM workshop.

ROSTER OF ATTENDEES

NAME	REPRESENTING	TELEPHONE NO.
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Charles H. Burk	LTU Aerospace & Defense Co. Vought Aero Div. Mail Stop 194-23 P.O. Box 225907 Dallas, TX 75265	(214) 266-5633
CAPT Tom Burke, USN	NAVSEALOGSUPENGACT/ NAVELEX DET MECH Box 2020 Mechanicsburg, Pa. 17055	(717) 790-2711
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Don Dansbury	US Army Tank-Auto Cmd. Warren, MI 48090	AV 786-6220
David Ells	Martin Marietta	(303) 977-7783
Len Gabour	Bendix GSD Rt 46 Teterboro, N.J. 07608	(201) 393-3014
Charles Gillett	Texas Instruments Lewisville, Texas	(214) 462-4671
Michael J. Goy	AFLC-CASC/CBRS Federal Center Battle Creek, MI 49016	(616) 962-6511 X9228
Richard B. Heggem	Westinghouse Marine Division	(408) 735-2409

ROSTER OF ATTENDEES (Continued)

NAME	REPRESENTING	TELEPHONE NO.
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Sue Jensen	Ford Aerospace	(714) 720-6458
Robert Keeler	NAVSEA Logistics Support Eng. Activity P.O. Box 2020 Mechanicsburg, Pa. 17055	(717) 790-3887
John Kick	ASD/AWZ WPAFB Ohio 45432	(513) 255-2687 AV 369-9228
Michael Long	E-Systems Melpar 7700 Arlington Blvd. Falls Church, VA	
Charles B. McClure	Martin Marietta Aerospace P.O. Box 179 Denver, Colorado	(303) 977-7898
Jim Miller	Lockheed Calif. Co. P.O. Box 550 Burbank, CA D/72-72 B90-4	(818) 847-9301
Dick Mooney	Control Data Corp. 3101-E. 80th Box 609 Minneapolis, Minn. 55440	(612) 853-4869
Ray Nichols	AT&T	(919) 279-7115
Jim Remiker	General Dynamics Convair Div., MZ23-6060 P.O. Box 85357 San Diego, CA 92138	(619) 573-8588
J. D. Richardson	5203 Leesburg Pike Suite 1403 Falls Church, VA 22041	

ROSTER OF ATTENDEES (Continued)

NAME	REPRESENTING	TELEPHONE NO.
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Art Rulon	USArmy DARCOM (MRSA) Lexington, KY	(606) 293-3415
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Ron Schrage	ASD/XRJ Wright-Patterson AFB OH 45433	1-513-255-6651
John Scotton	USA CECOM Ft. Monmouth, N.J.	(201) 532-3236
A. D. Signor	NAVSEASYSCOM NSWSES Code 4330 Port Hueneme, CA 93043	(805) 982-5844
Dave Smock	NAVSURWPNCEN White Oak Silver Spring, MD 20910	(202) 394-1573 AV 290-1573
Sue Swanson	Texas Instruments Home Address: 2012 Ports O'Call Plano, Texas 75075	(214) 995-6843
Ed Sweetman	The Bendix Corp. Guidance Systems Div. Route 46 Teterboro, N.J. 07608	(201) 393-2929
Dick Thomas	FMC Corp. San Jose, CA	(408) 289-3973
Julie Thomas	TRW 7600 Colshire Dr. McLean, VA 22102 W1/3530	(703) 734-6240

ROSTER OF ATTENDEES (Concluded)

NAME	REPRESENTING	TELEPHONE NO.
Clifford Wayne	Electronic & Support Serv.	(817) 633-2593
H. Peter Weiss	Joint Tactical Comm. Office (TT-LD-CM/DM)	(201) 532-7731
Roland Willuweit	AVRADA, ATTN: SAVAA-SIPE Ft. Monmouth, N.J.	(201) 544-2701

Workshop #5

COMPUTER SOFTWARE

(This workshop is combined with Workshop #4)

WORKSHOP #6
ENGINEERING DATA AUTOMATION

SUMMARY

The Engineering Data Automation Workshop is the potpourri of engineering data. Automation of engineering data goes from the pure computer program to complex management schemes. The workshop did not attempt to cover it all in the short time allotted, but did brush upon repositories, automation of the Acquisition Management Systems and Data Requirements Control List (AMSDL) and technical documentation.

Participation in this year's workshop was in balance with the participation in the overall symposium. There were 56 participants consisting of 38 from industry and 18 from various Government components. The Government participants were limited to Army, Navy, Air Force and National Security Agency.

Mr. James D. Richardson from DMSSO was called on to give the workshop the latest status of DoD activities in the automation world. Mr. Richardson said the DoD efforts are centered in three basic areas and each is considered a pilot program for that DoD component. The first program is the ARPS program which is under guidance of the Army. It is a fully automated publishing program and it has been in operation for approximately a year. This program is expected to be a full system with a CAD interface. The second area is under Air Force sponsorship and is called ATOS. It is an automated technical order system. The prototype is nearing completion and the production system is expected to begin in June 1984. The third system is under the sponsorship of the Navy and is known as the NTIPS. This program has had its ups and downs due to funding problems. At this time there is no specific system that you can literally put your hands on.

Other programs ongoing under DoD cognizance include a full digitized data base. It is currently under contract and is due to be delivered in 18 months. Few details were given on this system.

The final major mechanization efforts of DoD are centered around the repositories. The automation of the repositories has been mandated by Secretary of Defense Weinberger, and Congress has been advised that DoD is programming to have the repositories automated by 1989. There are 12 Army and Air Force repositories that are scheduled for automation under a joint Army/AF specification. The RFP has been on the street approximately 45 days and responses are due within the next couple of weeks. Awards of the contract should follow shortly thereafter.

DLA has four respositories that require automation. Its program will be conducted in two phases. The first phase involves the acquisition of four semiautomatic Infonetic systems. The semiautomatic systems will be developed into a full system during the second phase by conversion on a hit to hit basis. This is interpreted to mean that only those documents that are requested will be digitized. Therefore, DLA is not expected to digitize the

full repository, but only new and actively used documentation. New documents will be digitized prior to entry in the repository. The Naval Air Technical Services repository at Philadelphia is scheduled to be automated within the next 12 months. Competition was between Infonetics and DESRID, and recently the contract was awarded to Infonetics.

A presentation was given by Darrel Christenson on the use of bar coding for such things as inventory control, document tracking, tool tracking and materials requirements planning.

A discussion on what ADPA could do to assist the DoD in future and current automation programs was held. An interest was shown in development and application of the GENCODE and IGES. As a result of the discussion, the chairman will establish a liaison with DMSSO and request all proposed new/revised documents concerning digitization of documentation be made available to the Engineering Data Automation committee for review and comment. The first documents to be requested will be the GENCODE and IGES. Interested attendees will be forwarded copies of these documents for comment upon receipt.

During the discussion it was noted that lack of standardization of defining data made it difficult to automate the acquisition procedures. It was suggested that the committee develop selected data item descriptions to define the specific requirements for digitization of engineering data. Attendees of the workshop will be contacted after the meeting on an individual basis to determine the requirements and capabilities necessary to improve the engineering data automation program associated with DoD.

Based on the enthusiasm shown in the workshop this year, it is expected that a meaningful, ongoing program will be presented to the annual meeting next year.

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